TECHNOLOGY DEPT

TECHNOLOGY REVIEW

December 1953

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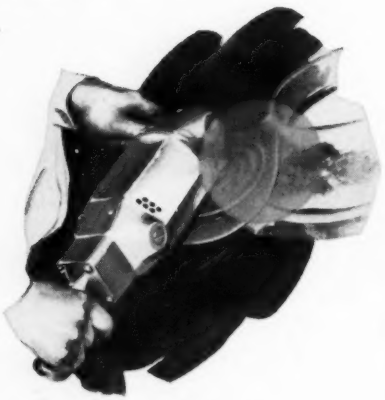

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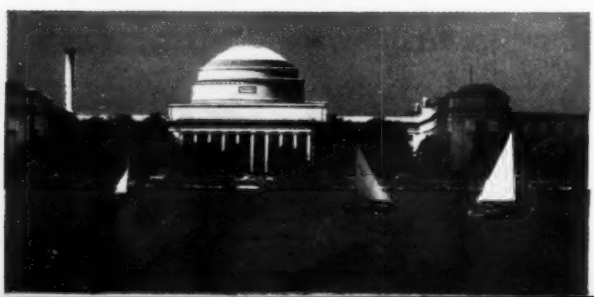

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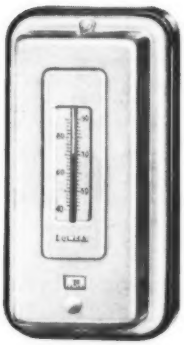

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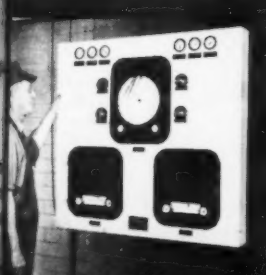

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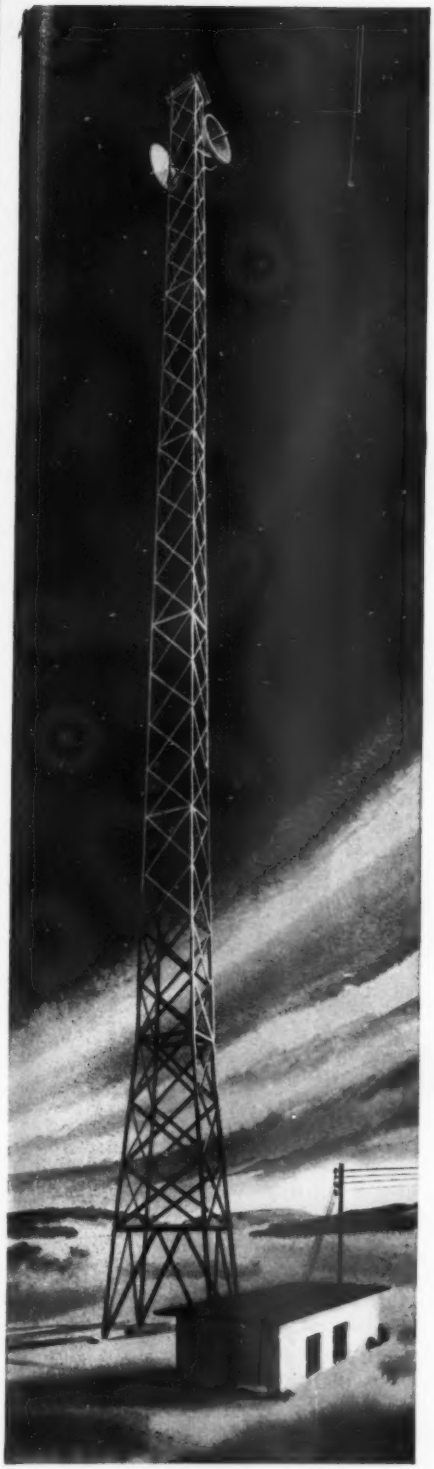

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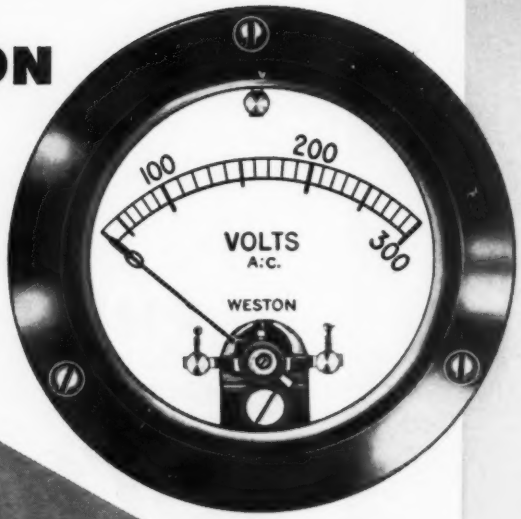
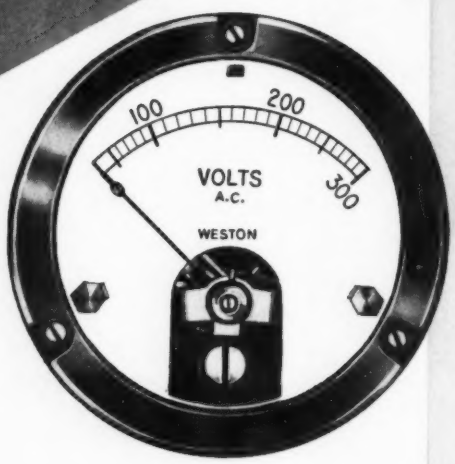
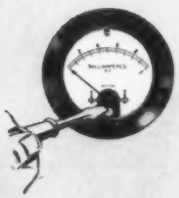


A-C ruggedized instruments





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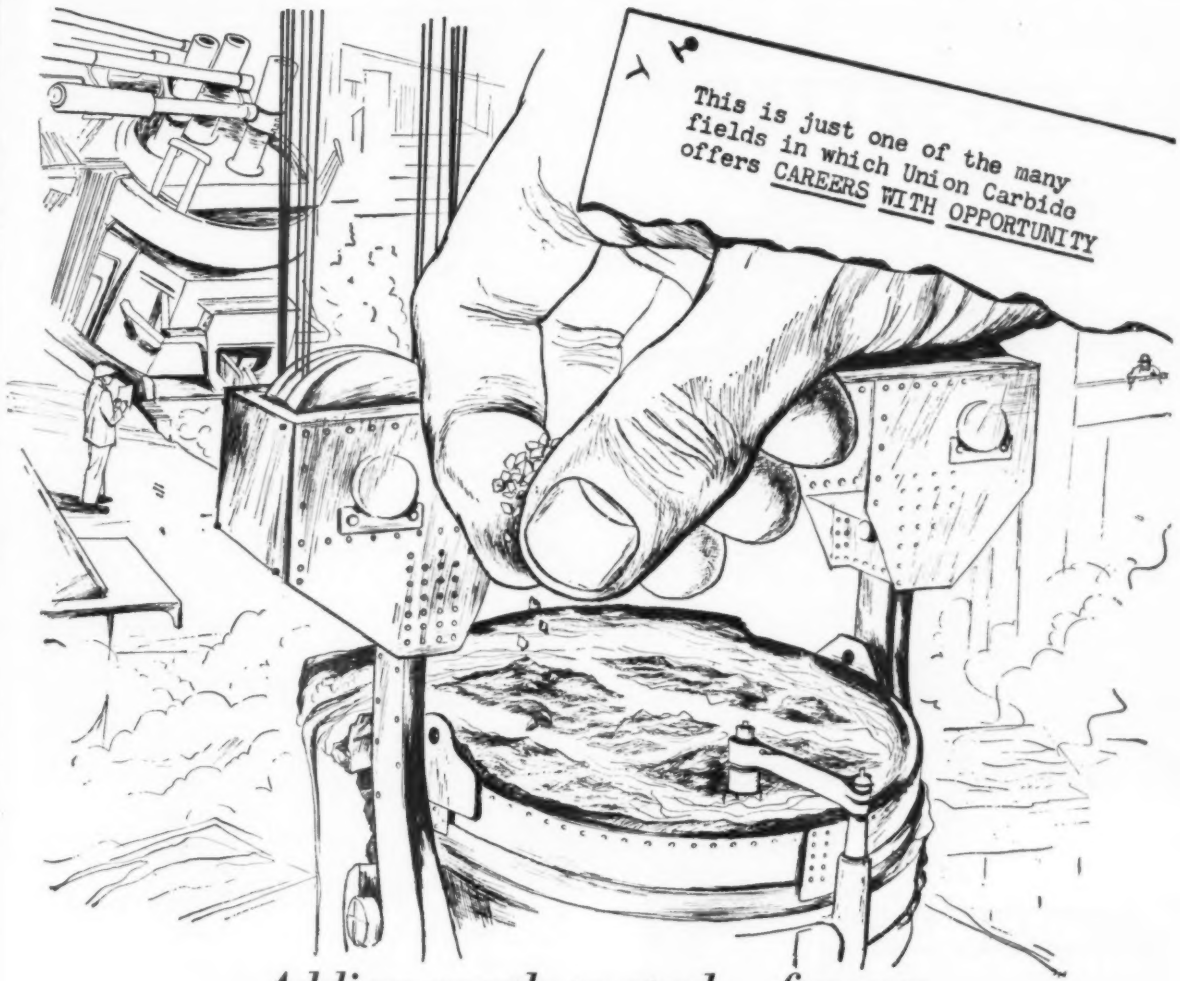

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THE TABULAR VIEW

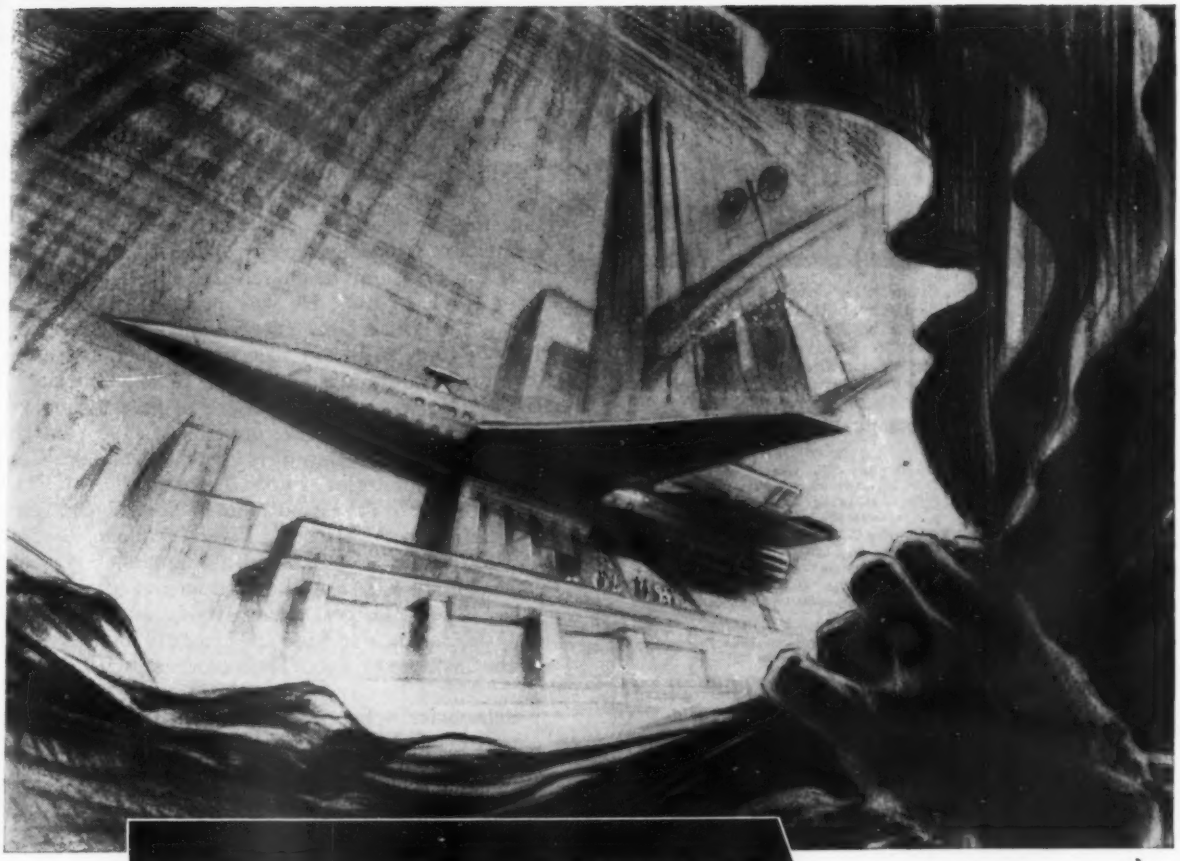
Dorrance Building. — This issue of The Review is devoted, almost entirely, to a description of the newest educational facilities at the Institute, and the use of the Dorrance Building by the Departments of Biology and Food Technology who, together, occupy this new structure. The description of the building itself (page 81) was written in The Review Office, and manuscript was reviewed by several who played important roles in the planning, building, or use of this new structure. Primary purpose of the lead article, this month, is to outline the physical structure of the building in sufficient detail that the rest of the articles in this issue will make a more effective contribution to an understanding of the use of this great new addition to the life sciences at M.I.T.

Biology in the Dorrance Building. — PROFESSOR FRANCIS O. SCHMITT, Head of the Department of Biology, provides an account (page 85) of the use to which the Dorrance Building will be put for teaching and research in the biological sciences. Dr. Schmitt has been head of the Department of Biology at M.I.T. since the summer of 1941. Born in St. Louis in 1903, Dr. Schmitt received the bachelor of arts degree from Washington University in 1924 and three years later was granted the degree of doctor of philosophy. From 1927 to 1929 he was National Research Council Fellow in the department of chemistry at the University of California. It was during this period that he also carried on advanced studies in the biochemistry department of University College, England, and at the Kaiser Wilhelm Institute, Berlin. Appointed assistant professor of zoology at Washington University in 1929, Dr. Schmitt became associate professor in 1934, and head of the department of zoology in 1939.

Biochemistry in the Dorrance Building. — PROFESSOR JOHN M. BUCHANAN began his association with the Institute on July 1, last, as head of the recently formed Division of Biochemistry in the Department of Biology. His article in this issue (page 87) deals with the Division's use of the new facilities which the Dorrance Building makes available. Dr. Buchanan was graduated in chemistry from DePauw University in 1938. He was awarded the master of science degree from the University of Michigan in 1939, and the Ph.D. degree in biochemistry from Harvard University Medical School in 1943. After three years as instructor and assistant professor in biochemistry at the University of Pennsylvania Medical School, he studied for two years, as a National Research Council Fellow, at the Medical Nobel Institute in Stockholm. Returning to the University of Pennsylvania in 1948, Dr. Buchanan was made associate professor in 1949, and professor in 1950.

Food Technology in the Dorrance Building. — PROFESSOR BERNARD E. PROCTOR, '23, Head of the Department of Food Technology, devotes his article in this

(*Concluded on page 70*)



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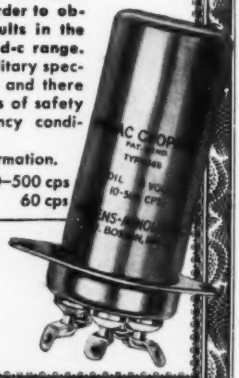

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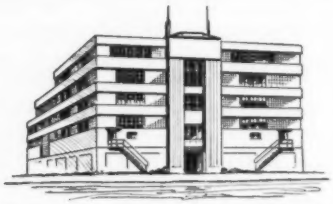
THE TABULAR VIEW

(Concluded from page 68)

issue (page 89) to the uses which the Department of Food Technology (including the Samuel Cate Prescott Laboratories) will make of the new Dorrance Building. Professor Proctor received the degree of bachelor of science in biology and public health from M.I.T. in 1923, and the degree of doctor of philosophy from M.I.T. in 1927. He was instructor in biochemistry at the Boston University School of Medicine from 1923 to 1926, and from 1926 on has been associated with the Institute's Department of Biology and Public Health. He was named professor of food technology when that Department was organized in 1944, and the following year became director of the Samuel Cate Prescott Laboratories of Food Technology. In 1952 he became head of the Department of Food Technology. In addition to the textbook, *Food Technology*, which he wrote with Professor Emeritus Samuel C. Prescott, '94, Dr. Proctor is the author of numerous papers published in scientific periodicals. He was associate editor of *Food Technology* from 1947 to 1949 and president of the Institute of Food Technologists for 1952–1953.

Salarywise. — By prewar standards, today's graduates from colleges of engineering and science manage to do quite well, financially speaking, when they leave the halls of learning to embark on their professional careers. A survey of the salaries earned by recent graduates of M.I.T., according to the degree awarded, has been made (page 78) by MRS. EVELYN B. YATES, Alumni Placement Bureau, and these results are compared with similar studies contained in the "1952 National Survey of Professional Scientific Salaries" made by the Personnel Department of the Los Alamos Scientific Laboratory of the University of California. Although not as extensive as might be desired, the data may help to answer the question, "Is an advanced degree from M.I.T. financially worth while?"



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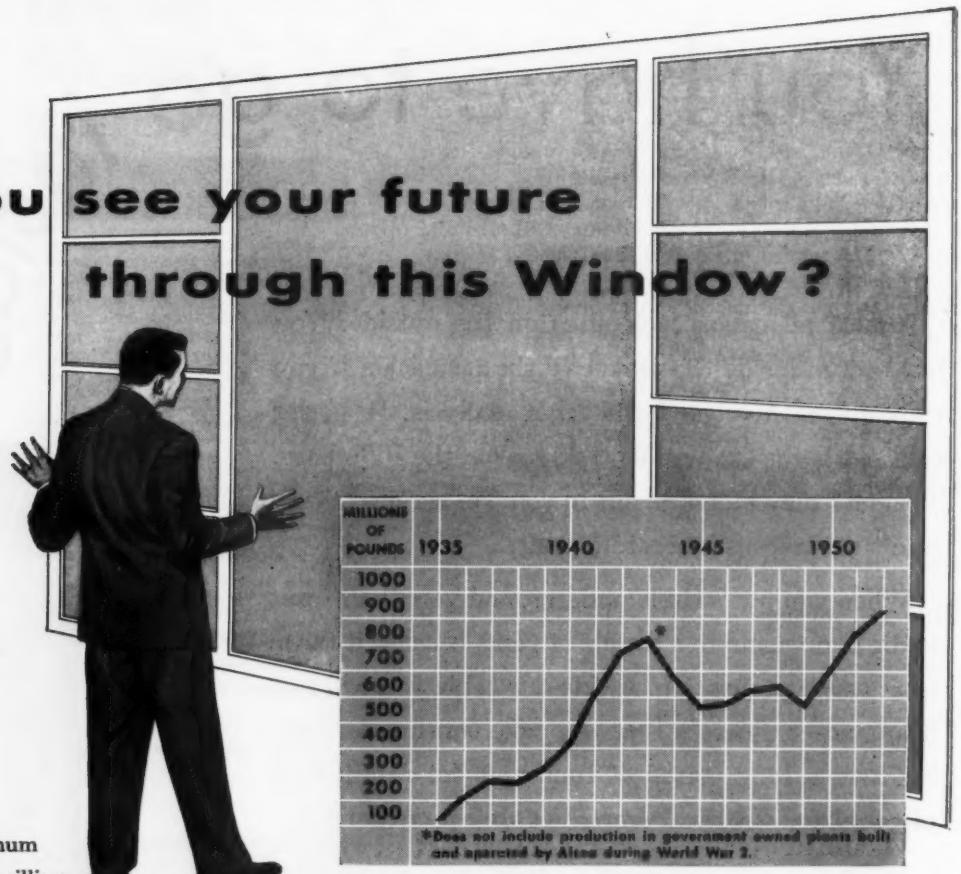

This is an aluminum window, one of four million that will go into buildings in 1953. Twenty years ago, it was just an idea in the mind of an Alcoa development engineer. Ten years ago, only a few thousand were made annually. Now, production *is increasing* at the rate of over half a million a year. This is just one of a torrent of new uses for aluminum which means that Alcoa must continue to expand. Consider the opportunities for you if you choose to grow with us.

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What General Electric people are saying . . .

C. W. LaPIERRE

Mr. LaPierre is Vice President and General Manager—Aircraft Gas Turbine Division

". . . In my opinion, research and development organizations, including our many capable universities, should always be primarily interested in exploration which leads to establishing principles. They should not attempt, by themselves, to direct the course of aviation progress. For example, they should establish the operating limits on a particular material or the relative merits of different thermodynamic cycles. But they should not try to dictate how their findings should be used. This responsibility must be left to the designer. Research and development organizations should work with the industry in helping establish limitations and principles; they should anticipate problems and solve them. Their solutions make it possible for the aircraft industry to overcome obstacles that might otherwise delay progress for years.

But regardless of *who* conducts our research and development projects, or how they are conducted, the nation's efforts in this field must not be allowed to dwindle.

The Soviet has, and will undoubtedly continue to hold, the advantage of mass—mass of manpower and material. We cannot hope to overtake them on those two scores. But our system of government is such that it encourages freer thinking and more rapid development. Our defense lies in the ability to outdevelop them—to neutralize their ponderous weight of arms with more advanced machines and methods. Our nation is blessed with the brain power and facilities to press this advantage. Our danger lies in the curse of lethargy that would allow them to lie fallow.

at The Air Force Association
Washington, D. C.

A. W. SCHMITZ and H. L. PALMER

Mr. Schmitz is Manager of Equipment Engineering, Industry Control Department

Mr. Palmer is Manager of Electronic, Regulator and Aircraft Engineering, Industry Control Department

". . . Today's high production speeds require controls with swiftness of response that can no longer be supplied manually. Self-regulating controls are the answer. At the same time, there's a constant evolution of control principles and amplifying means to obtain even faster speeds of response, and more accuracy of performance.

In the 1930's, the amplidyne—or rotating amplifier—was applied in industry where the sensitive capabilities of electronic tubes weren't needed, and where there was reluctance to use such fragile equipment. In subsequent years, however, control equipments were designed using the electronic tube and amplidyne in combination. Today, by contrast, the trend is toward replacement of both types with the static, or magnetic, amplifier.

Of tremendous help to the engineer in solving the complex control problems that lie ahead will be mechanical and electronic calculating machines. For in addition to solving mathematical equations, they can be used to simulate the electric machinery for which the control is designed. Thus, a more thorough test of the control can be made in the factory prior to installation at the customer's plant. This new technique has already reduced installation and tune-up time to a high degree.

Controls of the future may well include computers and information-storage devices to permit measurement and integration of operating factors in a process. That is, the control itself will make necessary calculations and automatically correct the process to get the desired end product. When we reach this stage of control, our nation's industrial productivity will have no limits.

G.E. Review

C. F. GREEN

Dr. Green is Engineer—Advance Developments, Aeronautic & Ordnance Systems Division

". . . The successful conduct of the rocket flight of a complex piece of experimental equipment is an arduous undertaking. Not only is it necessary to have equipment operating properly and reliably without personal attention; but also it is necessary to co-ordinate a large field of operations involving final missile assembly, handling and firing details, a network of optical and radar tracking stations, a system of radar receiving stations, a range safety group for protection of inhabitants and for command cut-off of rocket motor power in the event of a probably dangerous trajectory and a recovery group. Because of the large number of people involved in a firing, the date and hour of firing is fixed considerably in advance. Deadlines are not easy to meet with varied pieces of laboratory type equipment. There are problems of doing adequate pre-flight check-out of equipment under difficult field conditions—such as extreme temperatures, sand storms, rain, hail and winds. In general, each flight, since it carries different equipment, separately engineered for its particular requirements, places special problems upon the missile men as well as the experimental agency or agencies, all working together with a common incentive to accomplish the planned objectives.

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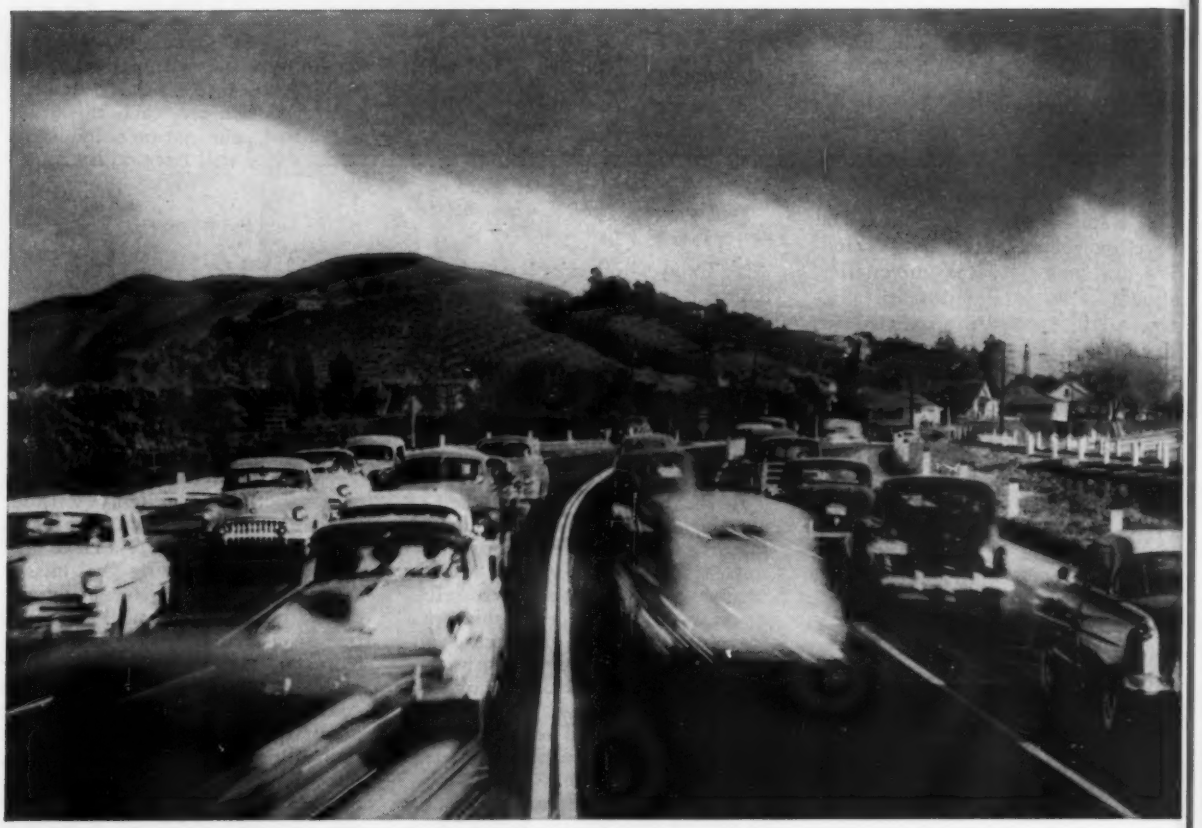

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GOODYEAR

LifeGuard, T.M.—The Goodyear Tire & Rubber Company, Akron, Ohio

Gravestone of Mother Goose (Nov. Contents page 11) is located in the Old Granary Burying Ground, beside Park Street Church, on Tremont Street, Boston, Mass.

How well do you know Boston?
Name of noted architect is carved on cornerstone of building that should be known to every Alumnus. Do you know where it is?

THE TECHNOLOGY REVIEW

TITLE REGISTERED, U. S. PATENT OFFICE

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

CONTENTS *for December, 1953*

Vol. 56, No. 2

STAIR HALL CONNECTING DORRANCE BUILDING WITH OLDER EDUCATIONAL BUILDINGS AT M.I.T. • *Photograph by Gottscho-Schleisner* ..... THE COVER

ATOMIC EXPLOSION IN ACTION • *Photograph from Edgerton, Germeshausen and Grier, Inc.* ..... FRONTISPIECE 76

SALARYWISE ..... BY EVELYN B. YATES 78
Survey of salaries earned by recent M.I.T. graduates working in fields of science and engineering

THE DORRANCE BUILDING ..... BY THE TECHNOLOGY REVIEW STAFF 81
Architectural features of the latest addition to the Institute's educational buildings are described

BIOLOGICAL SCIENCE AT M.I.T. ..... BY FRANCIS O. SCHMITT 85
An account of the Institute's teaching and research activities on the frontiers of biophysics, biochemistry, and physiology

BIOCHEMISTRY AT M.I.T. ..... BY JOHN M. BUCHANAN 87
Outline for curriculum in a comparatively new field in the life sciences recently established at the Institute

FOOD TECHNOLOGY AT M.I.T. ..... BY BERNARD E. PROCTOR 89
Use to which the Dorrance Building is put by the Department of Food Technology, for teaching and research, is outlined

THE TABULAR VIEW • *Contributors and Contributions* 68

THE TREND OF AFFAIRS • *News of Science and Engineering* 77

THE INSTITUTE GAZETTE • *Relating to the Massachusetts Institute of Technology* 93

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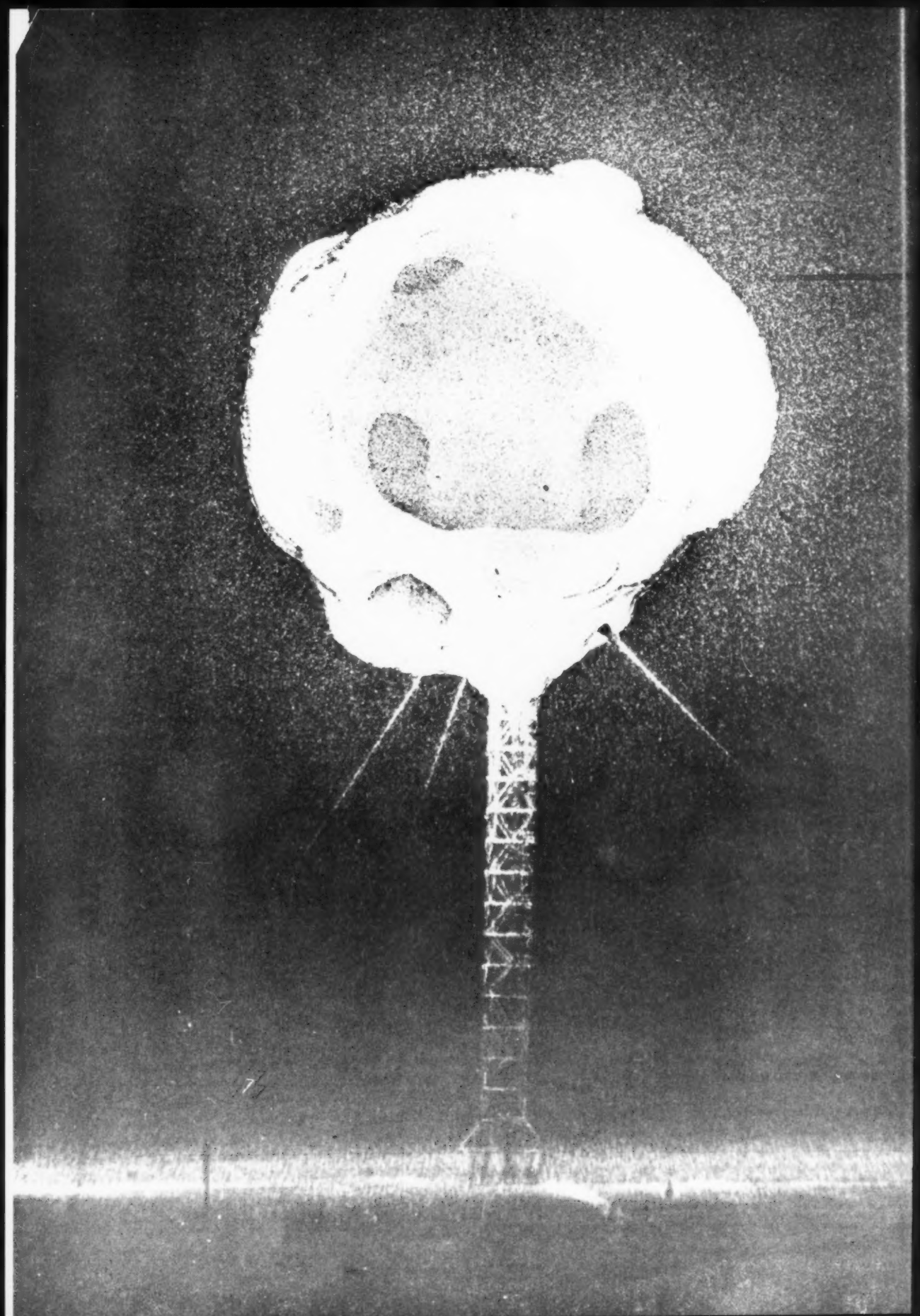
Publisher: H. E. LOBDELL

Published monthly from November to July inclusive on the twenty-seventh of the month preceding the date of issue, at 50 cents a copy. Annual subscription, $3.50; Canadian and foreign subscription, $4.00. Published for the Alumni Association of the M.I.T.: Horatio L. Bond, President; H. E. Lobdell, Executive Vice-president; Dwight C. Arnold, Richard S. Morse, Vice-presidents, Donald P. Severance, Secretary-Treasurer. Published at Hildreth Press, Inc., Bristol, Conn. Editorial Office, Room 1-281, Massachusetts Institute of Technology, Cambridge 39, Mass. Entered as second-class mail matter at the Post Office at Bristol, Conn. Copyrighted, 1953, by the Alumni Association of the Massachusetts Institute of Technology. Three weeks must be allowed to effect change of address, for which both old and new addresses should be given.



THE

TECHNOLOGY REVIEW

Vol. 56, No. 2 December, 1953

The Trend of Affairs

Atomic Explosion in Action

THE remarkable frontispiece photograph in this issue of The Review (opposite page), representing the work of Professor Harold E. Edgerton, '27, and his associates, is the result of a number of distinct contributions to modern science and engineering. First of all, the photograph is distinctly out of the ordinary because it shows the early phase of an atomic explosion. The shutter mechanism was actuated by the bright flash accompanying the explosion, and, while this feature is no longer unusual, it does depend upon technological progress in the field of photoelectric phenomena. Another unusual facet in the making of this print is the fact that the exposure time was but a few millionths of a second in duration.

As this issue of The Review goes to press, the print has just been released for publication by the Atomic Energy Commission, although the exposure was made at the Nevada Proving Grounds of the A.E.C. in the spring of 1953. The picture shows the very early fireball of an atomic explosion. A nuclear device, placed atop the tower, has just been detonated. The fireball has already consumed the upper portion of the tower and is seen progressing down the structure. The three lines from the top of the tower to ground are guy wires that had been used to stabilize the tower.

◄ ***Fiery ball from nuclear device disintegrates a steel tower shortly after detonation during tests made in the spring of 1953 at the Nevada Proving Grounds of the Atomic Energy Commission. Just released for publication by the A.E.C., this photograph was made by Professor Harold E. Edgerton, '27, and his associates. The exposure was made by means of the Faraday effect shutter, described on page 138 of The Review for January, 1951, which makes possible extremely short exposure times.***

Extremely short exposure times are required if any detail is to be recorded in photographs of explosive discharges. Obviously, no mechanical shutter is capable of opening and closing in a few microseconds — the exposure time required to yield a satisfactory print under the unusual conditions encountered in snapping an atomic explosion in action. Instead of the mechanical type of shutters, with which cameras are usually supplied, a polarized light-valve type of shutter making use of magneto-optic rotation, was used. As recorded on page 138 of the January, 1951, issue of The Review which outlines the principle of such nonmechanical shutters, the development of these high-speed shutters is a comparatively recent achievement. The operating principle on which they are based is by no means new, however. Indeed, as far back as 1822, Michael Faraday had determined that the plane of polarization of light traversing a material in a magnetic field is rotated when the light travels in the direction of the lines of force. The Faraday effect principle offers several important advantages over the electro-optic and birefringent methods, which also lend themselves to control of a polarized light-valve type of shutter. In both the latter methods, the angle of usefulness is limited to a low value; in addition, high voltages must be provided to bring about shutter action.

The photography of high intensity subjects, which persist at high levels of luminosity for fairly long periods of time, necessitates that the ratio of light transmission between the open and closed periods of shutter action be high. In the case of the magneto-optic shutter used in making this photograph, three crossed polarizing elements were employed to produce an open-to-closed transmission ratio of approximately 30,000,000. In other words, 30,000,000 times as much light passed through the shutter in the open condition as when the polarizing elements were crossed and the shutter was closed.

Salarywise — *By Evelyn B. Yates*

No matter how large one's income may be, the financial shoe seems always to pinch. Recent graduates of the Institute are especially interested in their professional progress as indicated by the frequently asked questions: "Are my classmates earning more than I am?" or "Could I do better, financially, if I changed my job?" A recent survey made by the Alumni Placement Office, and summarized in Fig.1, may help to answer such questions. Data for this graph were obtained from the 40 per cent of those members of the Classes of 1949, 1950, and 1951 who were not in military service at the time the study was made. The results set forth in Fig. 1 were compiled in May, 1953, from questionnaires sent out in March. No special claims are made for the validity of the graph. The size of the sample, the wide spread of salaries around each point on the graph, and the evident desire of participants to provide dependable data, nevertheless, support the belief that the information is reliable.

The graph of Fig. 1 shows the average salaries of men who have been working from two to four years. Salary ranges are given according to degree conferred and, in each case, average salaries as well as median, or halfway, values are indicated. Graduates of the Class of 1948 were not included in the survey. However, by averaging the salaries of S.B. graduates of that Class who registered with the Alumni Placement Office last spring, an average salary of $540 was indicated. The average starting salary of a person who received a bachelor's degree from M.I.T. in June, 1953, was $337 per month.

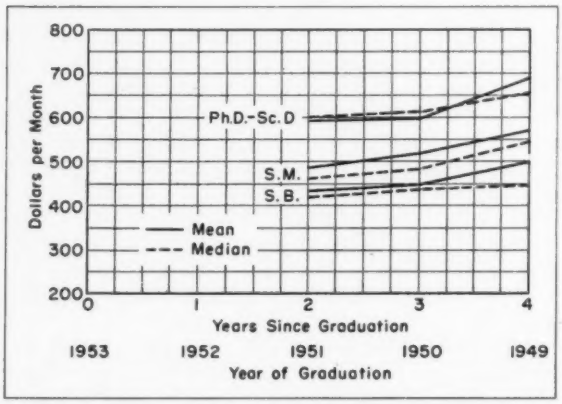


Fig. 1. Summary of salary data for three recent classes of M.I.T. graduates, according to degree conferred. Data from Alumni Placement Office.

Because men may wish to check their earnings as well as findings of the Alumni Placement Office against a study of a larger group, two graphs are reproduced from the "1952 National Survey of Professional Scientific Salaries" published by the Personnel Department of the Los Alamos Scientific Laboratory of the University of California. To quote their survey: "Returns were received from 197 contributors, including private industrial concerns, government agencies, AEC contractors, research institutes and consultants. The organizations reported salary data from 236 individual laboratories and covering 38,231 personnel holding academic degrees and engaged in research and development. The salaries reported were, for the most part, those in effect in August and September of 1952. . . .

"Employees whose duties are primarily supervisory or administrative, such as department heads or division leaders, have not been included in this study. . . . Production and profit-sharing bonuses, cost-of-living allowances, and similar adjustments to base salaries have been added to the monthly averages in cases where they were reported separately by the participants."*

The data for Fig. 2 do not differentiate between men holding bachelor's and master's degrees. Moreover the Los Alamos charts (Figs. 2 and 3) are based on time elapsed since bachelor's degree was awarded, whereas the horizontal scale for Fig. 1 is based on number of years since the highest degree was awarded. For purposes of comparison a man who received his doctorate in 1951 (two years since graduation) and who took four years to obtain this advanced degree, should enter Fig. 3 at the six-year mark.

Although a study of three classes is hardly adequate for the purpose, Fig. 1 may help answer the frequently asked question, "Is an advanced degree from M.I.T. financially worth while?"

* Wherever the data was given separately, profit sharing, cost-of-living allowances, and similar adjustments were omitted in the M.I.T. study.

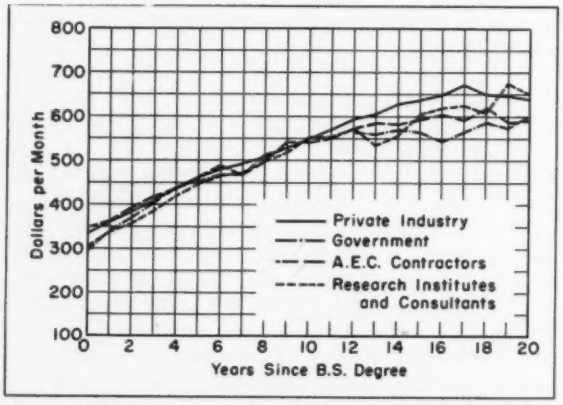


Fig. 2. Comparison of professional scientific salaries for those with bachelor's degrees, by general field of employment. Data from Los Alamos Scientific Laboratory.

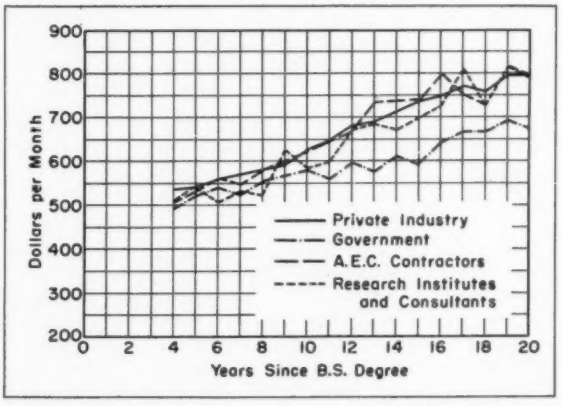


Fig. 3. Comparison of professional scientific salaries for those with doctorate degrees, by general field of employment. Data from Los Alamos Scientific Laboratory.

A.I.G.A. Recognition

THE Technology Review and Professor Harold E. Edgerton, '27, were accorded recognition in the Fourth Annual Magazine Show of the American Institute of Graphic Arts when this show opened its preview in New York on October 13. The A.I.G.A. Magazine Show is the only comprehensive exhibition of commercial magazines in the United States and affords opportunity to review, evaluate, and encourage high standards of accomplishment in the field of periodical publications.

Selected for exhibition in this show was the cover of the April, 1953, issue of The Review, reproduced in miniature at the right. The striking design of this cover, showing a young girl twirling a baton, is reproduced as this action would be seen at successive intervals of 1/60th of a second. The photograph was made by Dr. Edgerton, Professor of Electrical Measurements at M.I.T., and well known for his developments in flash photography, stroboscopic light sources, and contributions to photographic illuminants.

According to a statement of George Samerjan, chairman of the A.I.G.A. Magazine Show, "each entry honored by selection will have been so designated because of the magazine's achievement in attaining the maximum of interest, good taste and outstanding design and production under the circumstances of size, content, purpose and circulation."

Although the striking design of Professor Edgerton's photograph was undoubtedly the major factor in selecting the April cover for hanging, a wealth of technical information may be derived from this illustration, as Karl R. Kennison, '08, showed in the Mail Returns column in the July, 1953, Review. From the cover, Mr. Kennison located the parabolic trajectory of the center of gravity of the baton, determined the scale for the photograph from this trajectory and knowledge that successive exposures were 1/60th second apart, and then calculated the baton's length correctly to within less than 3 per cent of its true length of 29 11/16th inches.

Reproduction of The Review cover whose unusual stroboscopic photograph by Professor Harold E. Edgerton, '27, received recognition from the American Institute of Graphic Arts.

Plus Factors

THE day is long past when people subsisted mostly on vegetables raised in their own gardens, and on meat from animals raised and slaughtered locally. Today a great deal of our food undergoes processing, packaging, and distribution before reaching us. Because of this handling it has become expedient, sometimes necessary, to add certain materials to some foods to prevent deterioration, to improve physical properties, or otherwise to promote consumer acceptance.

Chemical pesticides, frequently applied to agricultural crops to combat insect pests, are another source of substances added to foods. Although pesticides are not intended to remain in foods as consumed, complete removal before the food reaches the consumer's table may be difficult or impossible. Still another source of food additives is the current practice of feeding or otherwise administering, to livestock and poultry, antibiotics or hormones designed to promote growth and thereby increase weight at the time the animal is slaughtered.

In recent years there has been substantial concern over possible baleful effects upon the consumer of these food additives derived from various sources. Indeed from 1950 through 1952 the topic came under the scrutiny of a congressional committee, the House Select Committee to Investigate the Use of Chemicals in Foods and Cosmetics, popularly known as the Delaney Committee. This group heard testimony that was published in four volumes totaling 2,745 pages. It published 98 pages of printed reports, presenting a majority recommendation that legislation be enacted to require toxicity tests of all food additives before they are used. A minority of the committee disagreed with this recommendation. Beyond doubt the question has two sides, and many ramifications.

The interest in possible toxic effects of food additives has now led attention into another facet of the question; their possible influences on flavor and other quality characteristics of foods. Recent research reports, of quality tests of foods grown with and without chemical insecticides, reveal that such attention is warranted. Thus the flavor of peanuts and peanut products – and even of foods fried in peanut oils – was found to be poorer when conventional insecticides were employed in growing the nuts than when they were grown without insecticide treatment. The flavor of sweet potatoes was likewise found to be adversely affected by use of some standard insecticides.

But similar studies of cherries gave equivocal results. Unfortunately the issue of food additives has been somewhat beclouded, because it has been prime ammunition for the sensationalist, the yellow journalist, and the food faddist. Alarm and sensationalism in this regard are unjustified, because no harmful effects to the human being from food additives are known. The wise approach is rather calm and orderly consideration, to forestall any possible future harm to the consumer. That such consideration is being given is evident from the account just given of activities of the Delaney Committee in Congress.

Furthermore, the Food and Drug Administration of the federal government in 1950 held eight months of hearings, concerning safe tolerances for residues in foods of chemical pesticides used in the raising of agricultural crops. The testimony taken has been reviewed by the United States Public Health Service as well as by the Department of Agriculture. It is expected that allowable insecticide residue tolerances will be promulgated by the government in time for the 1954 growing season.

Thus it is clear that possible toxic effects of food additives are receiving good attention. The consumer may also rest assured that possible effects of food additives on quality of foods will be dealt with ably by the food industry, who find it competitively advantageous to provide foods of as high quality as possible.

A Look at the Electronics Field

A DECADE ago "electronics" was a magic word to many in the engineering field as well as to the general public. Those employed or trained in the field were rapidly being absorbed into service for national defense in the development of radar, sonar, and similar systems of detection or communication. It was under such conditions that the present editor of The Review, then in Chicago, became one of the initiators of the first National Electronics Conference. Modestly planned as a national forum on electronic developments and their application for a body of 400 expected participants, the first conference on October 5-7, 1944, drew 2,300 scientists and engineers, as recorded in "Freedom Party" in the Trend of Affairs section of the December, 1944, issue of The Review. Every year since, the annual fall programs of the N.E.C. in Chicago have attracted national attention.

At the N.E.C. this year, scores of papers on technical topics were presented. While most of them were on highly specialized topics, a luncheon address delivered on September 30 by H. B. Richmond, '14, is of sufficiently general interest that The Review takes pleasure in extracting portions of Dr. Richmond's remarks entitled "Opportunities and Responsibilities of Employment in the Electronics Field." Said Dr. Richmond in his address:

"I would like to take a moment to comment on some of the educational phases of electronics, because it is from the technical institutions that come our personnel in search of employment. For the moment I am excluding graduate students in the sciences, while, in particular, I want to refer to those training in electrical engineering. Ten years ago nearly all of the electrical engineering courses had two options, colloquially referred to as heavy currents and light currents. The former were obviously for the public utility and heavy electrical manufacturing industry. The latter were what we now refer to as communications or electronics. The former usually dealt with the generation, distribution, and utilization of power together with electrical machinery design. Too often these courses became what is now sometimes referred to as 'cook book' courses, as they often are of the 'how to do' type. Yet, let there be not too much belittling of these courses, because they have produced many public utility and manufacturing executives.

"Since World War II, however, there has been widespread concern among electrical engineering educators and leaders of the large industrial corporations over the fact that the general field of electric power is not attracting students in sufficient number nor of adequate intellectual ability to meet the demonstrated needs of the times. Should schools continue to allocate faculty and facilities to a declining field? With the rapidly expanding use of electric power, dropping power courses is out of the question. Actually what seems to be needed is the broadening of the base of scientific substance and an upgrading of professional content in the broad fields of energy conversion and energy utilization, which would make it possible for a graduate to enter either the heavy current or light current field, as opportunity and desire presented themselves. The control and conversion of energy, whether it be megawatts or microwatts, is the core of the problem. All electrical engineers should henceforth receive instruction in materials as well as in magnetic and dielectric amplifiers and transducers. The treatment of the dynamics of energy conversion in a system is becoming much more important than steady-state studies. Engineering also must stay very close to the sciences.

"Whenever I discuss educational programs, I am always reminded of Thomas Jefferson's comment on college graduates. He said of some – fortunately a minority – 'They neither possess knowledge enough to be skilled in the sciences or the arts, nor industry enough to be useful in commerce and trade.' And at this point, I want to emphasize that while many less than average students will find employment in the broad field of electronics, the field is a highly technical one; it is rapidly advancing and terrifically competitive, and except for those satisfied with minor status, it has no permanent place for the type of persons referred to by Jefferson."

After recording the growth and common interests of the Radio Manufacturers Association, the American Institute of Electrical Engineers, and the Institute of Radio Engineers – all active in the electronics field – Dr. Richmond continued:

"Before we look at electronics a little more closely, let us briefly refer to the country as a whole. No matter what industry we are in, it cannot be overlooked that in the forty-two years of the existence of the I.R.E. the national debt has grown from 1.2 to 275 billions of dollars. Even with our substantial population growth, this means that in 1912 each individual in the country had a twelve-dollar share in the national debt. Today

(*Continued on page 120*)

Gottscho-Schleimer

As skyscraper among the Institute's educational buildings, the Dorrance Building dominates the Cambridge campus.

The Dorrance Building

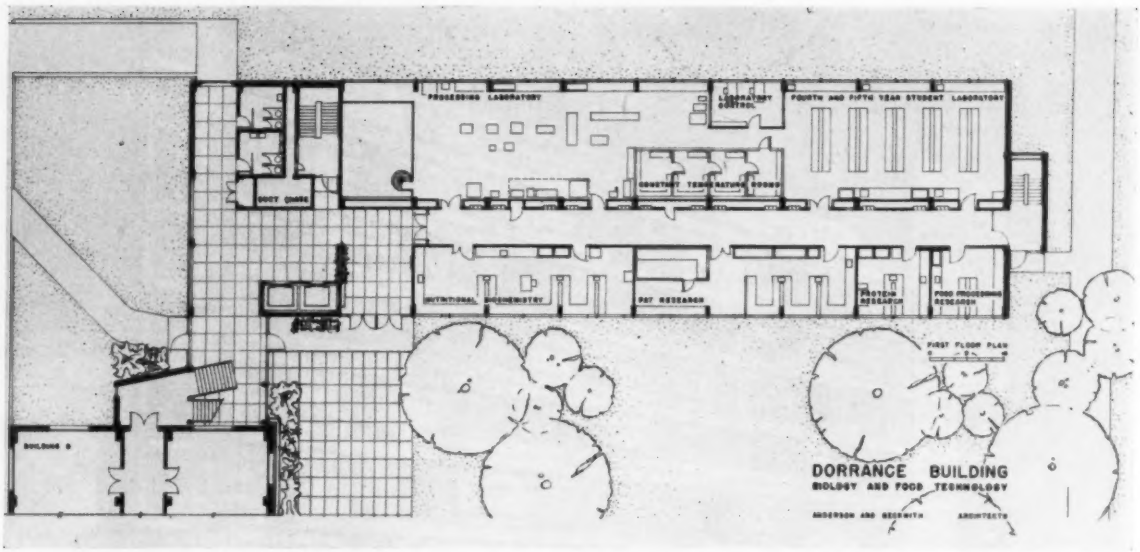
Latest Addition to the Educational Buildings at M.I.T. Houses the Departments of Biology and Food Technology

By THE TECHNOLOGY REVIEW STAFF

With the dedication of the John Thompson Dorrance Laboratories of Biology and Food Technology on June 25, extensive new teaching and research facilities in the life sciences became available at M.I.T. Named for a prominent member of the Class of 1895, the new building, eight stories in height, is the "skyscraper" of the Institute's educational structures; from its top floors, it commands a sweeping view of the Charles River and the Beacon Hill section of Boston to the south, and looks over Cambridge toward Harvard University on the north.

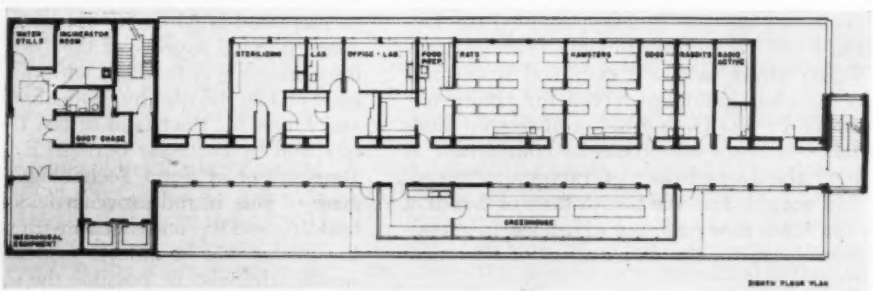
The opening of the new building enabled the Department of Food Technology to move from its quarters on Vassar Street, where it occupied space in a temporary wooden building erected for emergency use during World War II, to solidly constructed modern quarters which are sumptuous by comparison. It also enabled the Department of Biology to vacate space it had occupied on the fourth floor of Building 8, which space has now been put to full use in a modernization program for the Department of Electrical Engineering.

The most important part of any new physical facility for teaching or research, of course, is the use to which it will be put and the caliber of persons who will carry out their work in the new environment for the life sciences. How teaching and research in the life sciences progress side by side at M.I.T., how the Institute's program prepares its graduates to follow careers in the medical, food, pharmaceutical, and similar fields, how the work at M.I.T. aids in safeguarding the quality of modern foods, how radioactive tracer, x-ray, and electron microscope studies bring new techniques of instrumentation to bear on the life sciences, how the program in biochemistry is taking on increased importance – all of these are of primary concern. Such aspects of the Institute's work in the life sciences will be dealt with, in later pages of this issue of The Review, by Professors Francis O. Schmitt and James M. Buchanan of the Department of Biology, and by Professor Bernard E. Proctor, '23, of the Department of Food Technology. The primary purpose of this introductory article is to describe the building and its construction with sufficient detail that the reader will be able to evaluate more fully than would otherwise be possible the work being done by the two Departments now occupying the Dorrance Building.



Plan of the first floor (ground level) of the Dorrance Building. The corridor through the building is offset from center, with larger laboratories and classrooms toward the north, and offices and smaller classrooms facing the south.

Floor plans for the fifth floor, occupied by the Department of Biology, are representative of space arrangements throughout most of the Dorrance Building.



For the most part, the eighth floor is devoted to animal quarters, on the north, and a greenhouse where plants can receive sunshine throughout the entire day.

Entrance to Dorrance Building, looking toward Building 8, at the ground level. Glass tablet at main entrance on first floor commemorates John Thompson Dorrance, '95, for whom building is named.

Gottscho-Schleisner *M.I.T. Photo*

The new building is modern in every sense of the word. It is approximately 200 feet long and 57 feet wide, extending east from Building 8 with one corner near the Alumni Pool. The exterior is of buff brick, which harmonizes well with the gray limestone of the earliest structures. The north and south faces are composed almost entirely of glass, so that ample natural illumination is available during the day. Access to the building is by any of three entrances. The main corridor extending the total length of the building leads into Building 8. Close by, a separate entrance, near two elevators in the southwest corner of the building, leads to a parking lot and grass field, whereas entrance and separate stair well are located at the eastern end of the building near the Alumni Pool.

As one enters the building, a simple glass tablet, shown above, has been erected "in grateful tribute to John Thompson Dorrance, Class of 1895, creative food scientist and outstanding administrator whose energy, initiative, and skill greatly advanced the well-being of mankind." Turning to the left, two elevators operate between the basement and the eighth floor. A public telephone is located adjacent to the stair well near the elevators on the first floor. Entrance from the Dorrance Building to Building 8 of the older M.I.T. structures is available on the five lower floors of the Dorrance Building.

Exterior building surfaces are of glass and buff brick, and interior walls are either of buff tile or cinder block painted in light colors. Floors are of concrete or may be covered with linoleum or carpeting. Fluorescent lighting is used throughout all offices and corridors. In the corridor on each floor is an electrically operated clock, call bell, and adequate hoses and other fire-extinguishing apparatus. Air conditioning is provided for the animal house.

Although there are, of course, noticeable differences in the details and arrangement on each floor, in general all floors follow the same general plan. The offices, departmental headquarters, and most of the conference rooms are located on the south side of the building with rooms bearing odd numbers. On the north side of the building, across a long corridor that runs the entire length of the building, are the even-numbered rooms. As a usual matter the even-numbered rooms are given over to laboratories, classrooms, and related educational and research functions. A brief summary of the facilities found on each floor may be in order at this point.

The eighth floor is devoted to two rather specialized functions. The south side — toward the sun — contains a greenhouse where plants will prosper primarily under the aegis of the Department of Biology. On the north side of the building, in air-conditioned quarters, are the animal cages for rats, hamsters, dogs, and rabbits. The animals will be used primarily for studies in nutrition, and hence this portion of the building is under the administration of the Department of Food Technology. A floor plan for the eighth floor is shown on page 82.

The seventh floor, occupied by the Department of Biology, has offices for several professors and a seminar room on the south side. On the north side are laboratories for x-ray diffraction, spectroscopy, and medical instrumentation, as well as a large room for biophysics instruction.

The sixth floor, occupied also by the Biochemistry Division of the Department of Biology, contains offices and laboratories, including a large room for graduate students. There is also a laboratory for research in enzymology on this floor.

On the fifth floor are the headquarters of the Department of Biology, offices, and a large classroom. In addition, laboratories devoted to electron optical research, electron microscopy, and the chemistry of nerves are located here.

As usual, the fourth floor has a number of offices, but most of the space on this floor is devoted to instruction in undergraduate biology. A pair of refrigerated rooms is in the center of the building on the north side, and large laboratories are devoted to instruction in biology, physiology, and biochemistry. In addition there is a microbiology preparation room.

The third and lower floors are largely occupied by the Department of Food Technology. The headquarters of the Department, offices for professors, and a conference room are on the south side of the third floor. Laboratories for radioactive mineral research, and for food chemistry, together with a large classroom, complete the major rooms on this floor. The

Department of Biology has a laboratory of physical chemistry of proteins on the third floor.

The Samuel Cate Prescott Laboratories of Food Technology are located on the second floor. This floor is devoted almost exclusively to laboratory facilities, and includes rooms for flavor research, food radiation research, food packaging, biochemical engineering, histochemical research, bacteriological research, industrial microbiology, and a laboratory for graduate students.

The first floor houses laboratories devoted in large part to food processing, with smaller laboratories devoted to irradiation sterilization of foods, nutritional biochemistry, and fat and protein research.

The basement is, in large part, devoted to shop and storage and maintenance activities, but even here there are laboratories. The Biology Department is responsible for the administration of the shops. Food Technology research and aquaria of the Biology Department foster the research aspect of the building. A large room for laboratory apparatus and supplies is also located here, together with machine shops for both departmental and for staff use. Large rooms are also set aside for storage of foods and other materials used by the Departments.

The history of the Dorrance Building is brief but interesting. The new building is one of the major additions to the Institute plant to stem from its postwar development program. Badly in need of new quarters for both the Department of Biology and the Department of Food Technology, the Institute placed the laboratory high on the priority list of projects to be built as soon as possible. The building was made possible through generous grants by the Campbell Soup Company of which Mr. Dorrance was president for many years. James McGowan, Jr., of the Class of 1908, now serves as chairman of the Board of Campbell Soup Company.

In October, 1950, in his report to the Corporation, James R. Killian, Jr., '26, President of the Institute, indicated that the design of the new laboratory, by Anderson and Beckwith, architects, was nearing completion. The Sawyer Construction Company of Boston was chosen as general contractors for the erection of the building. Ground for the new building was broken on November 15, 1950. At these ceremonies, Oliver G. Willits, vice-chairman of the Board of Campbell Soup Company, and Mrs. John Thompson Dorrance made presentation addresses for the donors, and President Killian and Karl T. Compton, chairman of the Corporation, made acceptance addresses for the M.I.T. Administration. The Dorrance Building was virtually completed and occupation of the building began in the summer of 1952. By Alumni Day, June 15, 1953, the Dorrance Building was ready for its first "open house" reception, and many who visited the Institute on Alumni Day took opportunity to inspect the splendid new facilities.

Speakers who took part in the dedication ceremonies of the Dorrance Building on June 25 included (in reading order): James R. Killian, Jr., '26, Detlev W. Bronk, George R. Harrison, Francis O. Schmitt, and (standing) Oliver G. Willits. Bernard E. Proctor, '23 (hidden by Mr. Willits), also took part in the dedication addresses.

M.I.T. Photo

The Dorrance Building was dedicated on June 25, at exercises attended by distinguished biologists and food technologists from various parts of the world. George R. Harrison, Dean of the School of Science, presided at dedication ceremonies at which the speakers were Mr. Willits, President Killian, and Professors Schmitt and Proctor. A scholarly address of dedication was made by Detlev W. Bronk, then President of the Johns Hopkins University and of the National Academy of Sciences, now President of the Rockefeller Institute for Medical Research.

Following luncheon, scientific symposia on "Perspectives in Quantitative Biology" and on "Global Concepts of Food Technology" were held in the afternoon. Professor Schmitt was chairman of the symposium on "Perspectives in Quantitative Biology" at which papers were presented by: Professor Paul A. Weiss of the University of Chicago, on "Engineering Principles in Tissue Growth and Repair"; Professor George W. Beadle of the California Institute of Technology, on "The Place of Genetics in Biology"; Professor A. Baird Hastings of Harvard Medical School, on "Changing Frontiers of Biochemistry"; and Professor John T. Randall of Kings College, University of London, on "The Structure of Nucleic Acid and Some Biological Implications."

The speakers at the symposium on "Global Concepts of Food Technology," under the chairmanship of Professor Proctor, were: Samuel C. Prescott, '94, Professor of Industrial Biology, Emeritus, at M.I.T., on "Food Technology Horizons – Past and Present"; William H. Cook of the National Research Council of Canada, on "International Problems of Food Technology and Their Solution"; C. Glen King of The Nutrition Foundation, Inc., on "World Nutrition and the Role of Food Technology"; and John R. Robinson of the U.S. Atomic Energy Commission, on "Peacetime Applications of Atomic Energy." The Institute of Food Technologists sent greetings with Berton S. Clark of the American Can Company Research Laboratories.

A new chapter in the Institute's history began when, in new quarters, the Department of Biology opened its first full year of operation with the beginning of the school year in September, 1952, and the Department of Food Technology inaugurated its working program in the spring of 1953. If the past performance of these Departments, or the caliber of the addresses at the opening symposia, are indicative, the chapter about to unfold in the Dorrance Building will be a brilliant one.

Gottscho-Schleisner

General view of conference room, fifth floor Dorrance Building, adjoining headquarters of the Department of Biology. Through open doors, offices beyond the conference room are, in order, headquarters of the Department of Biology, office of Professor Richard S. Bear, Executive Officer of the Department, and a smaller office.

Biological Science at M.I.T.

An Account of the Institute's Teaching and Research Activities on the Frontiers of Biophysics, Biochemistry, and Physiology

By FRANCIS O. SCHMITT

THREE events highly significant in the history of the life sciences at Technology occurred during the academic year 1952–1953: The new John T. Dorrance Building was completed and occupied by the Departments of Biology and Food Technology; these new facilities were dedicated with inspiring ceremonies on June 25, 1953; and a new Division of Biochemistry was established.

Despite the fact that M.I.T. was one of the first American institutions to offer an undergraduate curriculum in biology, Alumni, friends, and visitors continue to express surprise that we offer undergraduate instruction in biology at the Institute. Actually much care and thought are devoted to this aspect of the teaching program and the new facilities furnish new opportunities to improve this instruction. From half to two-thirds of Course VII undergraduate majors are premedical students. An unusually high percentage (frequently all) of these students is accepted by medical schools and their record in medical school has proven very good.

Teaching Laboratories

The undergraduate teaching laboratories are concentrated on the fourth floor. The nine bays on the north side provide for the laboratory instruction in biology (general biology, genetic cytology, embryology, which are sophomore and junior subjects), physiology (general physiology and enzymology which are senior and graduate subjects), and biochemistry (introductory and advanced biochemistry and microbiology, given in the junior, senior, and graduate years). Each laboratory has an associated

◀ *Large classroom on the third floor of the Dorrance Building, which is also used for seminars and colloquia.*

Gottscho-Schleisner

This fourth-floor laboratory, for instruction in biochemistry, is typical of the experimental and research facilities with which the Dorrance Building is provided. ▶

preparative or instrument room. There is a "morgue" for the biology laboratory. Both the physiology and biochemistry laboratories have refrigerated rooms. The fact that almost wholly the sides of the building are glass insures excellent illumination. However, in addition, the artificial illumination is of the most modern enclosed tubular fluorescent type. Gone are the days of antiquated and poorly illuminated laboratories and offices!

By careful planning these student laboratories are multifunctional: classes in different subjects do laboratory exercises in the same laboratory at different times during the week. Thus the elementary biology course shares a large laboratory with that in genetic cytology in the fall term and with embryology in the spring term. General physiology shares a laboratory with enzymology in the fall term. The microbiology laboratory is equipped with the most modern facilities for teaching the biochemistry of microorganisms – the emphasis is on this aspect rather than on the more classical and applied aspects of bacteriology and microbiology. This subject will be under the supervision primarily of the Division of Biochemistry for the present. However, the subject represents a highly significant segment of modern biology, and the emphasis placed upon it at M.I.T. may be expected to increase rather than decrease. The Department of Food Technology is also, of course, deeply interested in microbiology, particularly in its applications to problems in food technology and nutrition.

Concentration of laboratory teaching on one floor has many advantages. Not the least of these is the close association which it fosters between undergraduates with widely varying interests – from the sophomore to the senior level.

Parenthetically it may be mentioned that, beginning with the next spring term, an elective course of lectures and demonstrations, primarily of a terminal nature and carrying no prerequisites, will be offered to all M.I.T. men on Perspectives in Life Sciences. The Department rejoices that this long-cherished wish, made possible by the recent changes in freshman requirements, is about to become a reality.

Facilities for Graduate Students

Between 30 and 40 graduate students are enrolled in the Department each year. The laboratories for the advanced, elective courses taken by these students are located in areas under the supervision of particular staff members. Thesis investigations are also carried out in such specialized laboratories. This high degree of differentiation is made necessary by the complicated technical nature of the physical and chemical equipment used in most of the graduate and postdoctoral teaching and research. Although the graduate or postdoctoral students frequently must do their research in the large laboratory centers where the particular equipment is concentrated, the small

(*Continued on page 112*)

Biochemistry at M.I.T.

Outline for a Program Now Operating in a Comparatively New Field in the Life Sciences

By JOHN M. BUCHANAN

As Professor Francis O. Schmitt, Head of the Biology Department, has mentioned in his article for The Review, "Biological Science at M.I.T." (page 85), the Division of Biochemistry was established as an autonomous unit within the structure of the Department of Biology on July 1, 1953, to expand the teaching and research functions in biochemistry for the Department. The new Division occupies the entire sixth floor of the new John Thompson Dorrance Building and also has some research areas on the fourth floor where the student teaching laboratory is also located.

Formal Establishment of Biochemistry at M.I.T.

Although biochemistry has now been organized within a formal structure at the Institute, this does not mean that it is a new discipline of the campus. Courses in biochemistry have been offered in the Department of Biology for several years, and research instruction leading to the Ph.D. degree in biochemistry has been a regular part of the Department's function. In addition, biochemical activities in both the fields of teaching and research have been carried out in the Chemistry Department and in the Department of Food Technology. The establishment of biochemistry in a formal sense should provide a focal point for the activities in this biological science at the Institute and help to provide instruments and materiel for the furtherance of teaching and research in this field.

At this time the author welcomes the opportunity to indicate a few of our aims and ambitions for research and teaching at the Institute. At this early stage of our operations it is feasible to give only a broad outline of the program to be pursued. There are many Faculty members, not only of the Biology Department but also in other Departments of the Institute, who have an interest in biochemical training and who will certainly make contributions to the final program.

For the most part, training in biochemistry has been done in departments located both in our medical and agricultural schools. It is quite natural that this should be the case since biochemistry deals in large measure with the reactions that occur in the living human or in the living animal. Biochemistry has now grown to such magnitude in the medical world that it has long ago been established as a major course in the preclinical curriculum in almost all medical schools. In the first stages of its development, prior to its establishment on separate footing, the material of biochemistry was taught in many cases by the department of physiology, and naturally the teaching and research in this field were strongly oriented toward physiology and medicine.

Through the combined efforts of the microbiologist, the biochemist, and the organic chemist, many important developments have been achieved in the medical field, primarily in the synthesis of antibiotics, hormones, and vitamins. These advances in the above fields have been sustained with enthusiastic support by the public who have contributed generously to funds for furtherance of scientific research related to public health. The growth of biochemistry has been fostered in great measure by this financial support.

Gottscho-Schleisner

General view of laboratory for instruction in biophysics, on the seventh floor of the Dorrance Building

During this growth the biochemist, who was originally part physiologist, has ramified his interests.

Biochemist Defined

There is now the biochemist who is interested in the metabolism of foodstuffs in the body. There is also the enzymologist who is concerned with the action and properties of enzymes. Nutrition is likewise an important branch of biochemistry. The bioorganic chemist who works in the field of natural products has created his own unique field which is closely associated with biochemistry. The physical chemists are making important contributions in the description of the physical properties and structure of biological materials. Finally, there is the biochemist who is interested in the problems of cellular physiology. He is concerned primarily with the organization and function of individual cells in the body; how cells divide and multiply.

It is difficult, in fact, to define a biochemist since he is formed from such a variety of interests. It is important that an incoming student in biochemistry be able to follow any of the above interests at the Institute. Many of these interests are already present at the Institute; in the Biology and Chemistry Departments and in the Department of Food Technology. An important function of the Division of Biochemistry will be to expand these interests and to fill in areas which have not been particularly developed here. In the field of research the major projects of the Division will be primarily in the field of enzymology and intermediary metabolism. Considerable use will be made of radioactive tracers in this research.

Another particularly attractive area of development will be the attempt to apply biochemistry to problems of cellular physiology. This will be a new adventure by the Division in an area of old interests. Undoubtedly many of the new and exciting problems of biochemistry lie in this direction. The scientific atmosphere and interests in the Biology Department should augment and catalyze such activities.

Gradually, a program in all fields of biochemistry will be developed on the campus which should produce well-trained and well-rounded biochemists. A biochemist graduate student will profit by his contact with courses in physical chemistry, instrumentation, and cellular physiology in the Department of Biology, and by his courses in the chemistry of natural products given in the Chemistry Department. A thorough training of a biochemist in the fields of organic and physical chemistry is an important feature of his curriculum. Although the philosophy of a biochemist may be biology, the tool of his research is chemistry.

Revision of Courses

The immediate endeavor of the Division will be to revise the present basic course in biochemistry so that elementary aspects of the fields of enzymology, intermediary metabolism, and microbiology will be included and integrated. As time goes on, courses in more specialized areas of biochemistry will be added to the curriculum. A fine opportunity exists to correlate courses in biochemistry and cellular physiology.

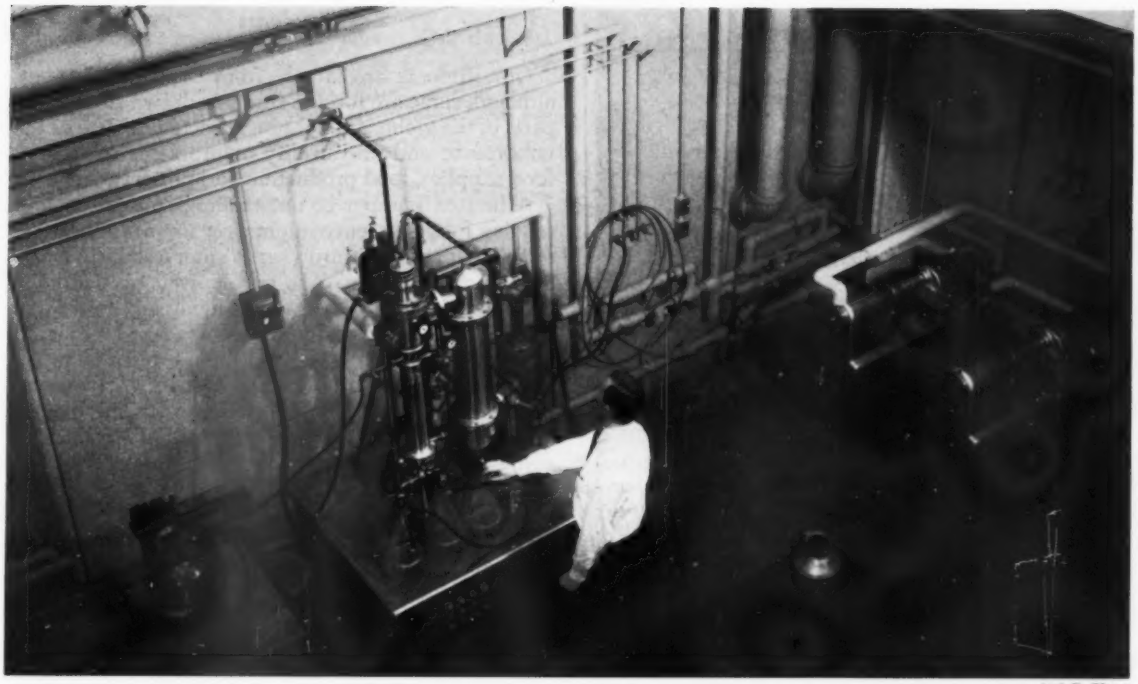
The Division makes no distinction in its interest in both graduate and undergraduate teaching. All students will take the same elementary course. Although many of our undergraduate students will be premedics, no special attempt will be made to develop a medical biochemical course. It is felt that premedics would profit in the long run by a general course in biochemistry and that there is no need for specialization at the undergraduate level. A member of the Division will serve as one of the Department's two advisers for medical students.

The Institute has contributed generously toward the creation of the facilities for teaching and research in biochemistry. A mass spectrometer and Geiger counters will be available for the measurement of stable and radioactive isotopes. A large "preparation room" contains an ample cold room and a smaller subzero room for the preparation of enzymes. Centrifuges serving all purposes have been an important part of our initial expenditures. An electrophoresis apparatus for the preparation and characterization of enzymes has also been purchased. The Division has been almost completely equipped, and began research and teaching this fall.

It is a pleasure on my part to thank at this time the Administration and Professor Schmitt for their enthusiastic and generous support of the founding of the new Division of Biochemistry. Their ambition and enthusiasm have been infectious. Finally, I feel considerable obligation toward friends in all branches of the Institute and on the architectural staff who have done much to translate efficiently our wishes and plans into a physical reality.

Gottscho-Schleisner

Seminar room on the seventh floor of the Dorrance Building



M.I.T. Photo

Pilot plant studies on the engineering problems of fruit-juice concentration are studied in the Food Technology Laboratories of the Institute.

Food Technology at M. I. T.

Since 1945, When It Was Organized as a Separate Unit, the Department of Food Technology Has Enjoyed a Considerable and Wholesome Expansion

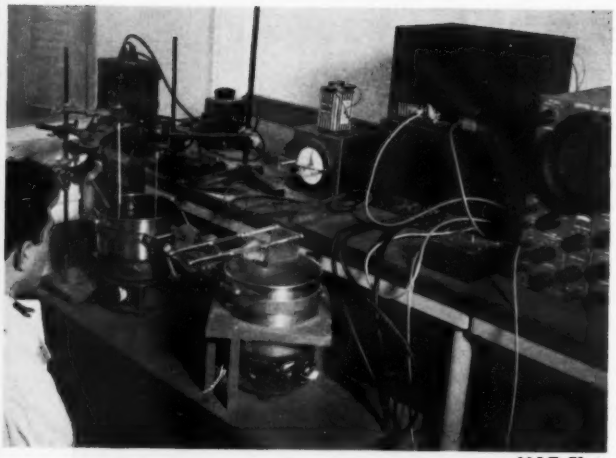
By BERNARD E. PROCTOR

THE dedication, on June 25, 1953, of the splendid John Thompson Dorrance Building, which serves as the new home for the Department of Food Technology, marks another milestone in the progress of this most recently established Department at M.I.T. Since 1945 when this Department was first organized, its field of activities has been considerably extended. Originally comprised of two professors and several research staff members, the Department has greatly enlarged its activities since its establishment, to the extent of now having eight faculty members and a personnel of over 40 individuals.

Definition and Objectives of Food Technology

As many of our readers may not be familiar with what constitutes food technology and its objectives, the following information regarding the teaching and research goals of this Department may be pertinent to Review readers.

Food technology may be defined as the application of science and engineering to the production, preparation, processing, packaging, distribution, and utilization of foods. The primary objectives of food technology are: (1) to train students to be able to take their places in the food industries as technical men capable of becoming executives and leaders of the future in this field; and (2) to prepare men for positions of leadership in food technology departments in other educational institutions. Our Department at M.I.T. aims especially to send forth into industry and into teaching graduate students skilled in the most recent methods and techniques in food technology. To this end there is needed, in addition to the formal class teaching of students, a research program concerned with fundamental research of a type related to the future potential utilization of such basic principles and facts as may be applicable in the food industries. In other words, fundamental studies are needed involving chemistry, bacteriology, nutrition, the com-



M.I.T. Photo

Modern food-processing studies require temperature measurements at intervals of microseconds. This equipment was devised in the Food Technology Laboratories for such purposes.

plex field of food flavors, and, on the practical side, packaging, some phases of engineering, and also radiation chemistry.

Our philosophy concerning the best methods of training food technologists was unique when it was initiated here at M.I.T., but numerous colleges teaching food technology are now incorporating the ideas here developed. These ideas are, in essence, to give our undergraduates a broad basic training in the underlying sciences (physics, chemistry, bacteriology, and mathematics) and thus to try to establish a sound pattern for the engineering control of food-process applications, with only slight specific investigation into commodity industries until the graduate years. This training is quite distinct from that of schools that are concerned entirely with specific commodities and interests, such as milling, dairy products, and meat.

Students

Our students are largely from the United States, although some are foreign students drawn from many parts of the globe, as might be expected in view of the importance and universality of problems relating to food supplies, food production and preservation.

A limited number of outstanding students in our regular four-year curriculum are, upon application, selected during the third year to enter a slightly modified fourth-year course, to be followed by a fifth, or graduate, year. A period of six months between the fourth and the fifth year in this course may be spent in technical positions in selected food industries, to enable each student to have some industrial experience before completing his academic work. This course leads to the degrees of S.B. and S.M. in Food Technology, awarded simultaneously at the end of the graduate year.

Recently, in response to suggestions from industry, an addition was made to the curriculum and we now have an option in biochemical engineering, which embraces fundamentals essential to both food technology and microbiology and which also places somewhat more emphasis on chemical engineering. This combination of courses is designed to train men for the fermentation industries, the rapidly growing antibiotic manufacturing industries, and similar biochemical industries, which have until recently found it necessary to train their own men.

Our graduates have provided the personnel for both large and small food enterprises. In addition, a number of our students have been chosen as members of the staffs of other universities, which have selected the type of training in food technology at the Institute as the best in this field.

In general our S.B. graduates go into production jobs in the food industry or into positions concerned

The use of radioactive calcium in nutrition studies requires the most modern electronic counting mechanisms such as are shown in this picture in the Department of Food Technology.

with the development of new products. Our doctoral men are more commonly employed in more advanced research laboratories of the food industries or of other educational institutions. A number of them have recently accepted professorships in other universities.

Aim of Teaching and Research

In all the teaching and research in the Department – and research is looked on as an important means of teaching – the aim is to supply the rapidly expanding food industries with competent men who will provide excellent staff for industry in the days to come. An extremely close liaison is maintained with industry, as it is believed that by such a community of interests a substantial bridge can be constructed between the food-manufacturing industries, the governmental and health authorities relating to foods and nutrition, the research laboratories concerned with agricultural developments, and the food-equipment manufacturers, on the one hand, and M.I.T. and its Food Technology Department, on the other hand. This bridge can be advantageously strengthened in the years ahead, to the mutual advantage of all concerned. It is obvious that such a bridge must be a two-way road on which traffic in both directions is not impeded.

It has been our intention to conduct research in areas that present problems and difficulties of such scope that few food companies could afford to conduct studies in these areas in their own separate laboratories. It has also been our intention to conduct research in areas in which the specialized background of our staff members may be particularly helpful and in areas involving problems where our exceptional facilities may offer unique advantages.

Among the research projects of special interest, in which significant progress has been made in the past decade, may be mentioned the studies on food freezing under the direction of John T. R. Nickerson, '32, Assistant Professor of Food Processing; the development of methods and techniques for the evaluation of food flavors under the direction of Ernest E. Lockhart, '34, Associate Professor of Food Chemistry; the researches on nutritional biochemistry conducted by Professor Robert S. Harris, '28, and Henry Sherman, '46, Assistant Professor of Biochemistry of Nutrition; and the research on sterilization with ionizing radiations under the direction of the author and Samuel A. Goldblith, '40, Assistant Professor of Food Technology. Mention should also be made of the fundamental research in microbiology and antibiotics conducted by Cecil G. Dunn, '30, Associate Professor of Industrial Microbiology, whose comprehensive textbook has been translated into Spanish and Japanese.

Our new quarters have, among their facilities, one of the finest animal laboratories in any educational institution. We also have a kilocurie source of radioactive cobalt-60, which has been most useful in the conduct of our research on food irradiation and the changes in chemical compounds and microorganisms accompanying such irradiation. Arrangements are currently under way for housing, in a special building, the only actual source of atomic fission by-products, and this source is to be used to continue the studies on the effect of gamma rays on foods.

The most modern electronic equipment, such as this rapid scanning spectrophotometer, are used in evaluating the effect of processing on change in food color at M.I.T.

Food research today, in common with other types of research, is rarely a one-man affair. Numerous projects and parts of projects undertaken by this Department could never have been initiated or brought to completion without the generous co-operation we have had from the members of other Departments of the Institute, including Biology, Chemical Engineering, Chemistry, Electrical Engineering, Mechanical Engineering, Physics, and some of the combined groups such as the Laboratories of Nuclear Science and Engineering, and Spectroscopy.

As two examples we may cite the co-operation of Robert J. Van de Graaff, Associate Professor of Physics, and Professor John G. Trump, '33, of the Department of Electrical Engineering. These men were responsible for the development and design of the high-voltage generators, and these facilities of the High Voltage Laboratory we in the Department of Food Technology have used in research on the cold sterilization of foods, first by x-rays and more recently by cathode rays. Without such splendid co-operation as is available in our institution, our efforts would have been seriously impeded and in some cases would have been impossible.

Sponsors

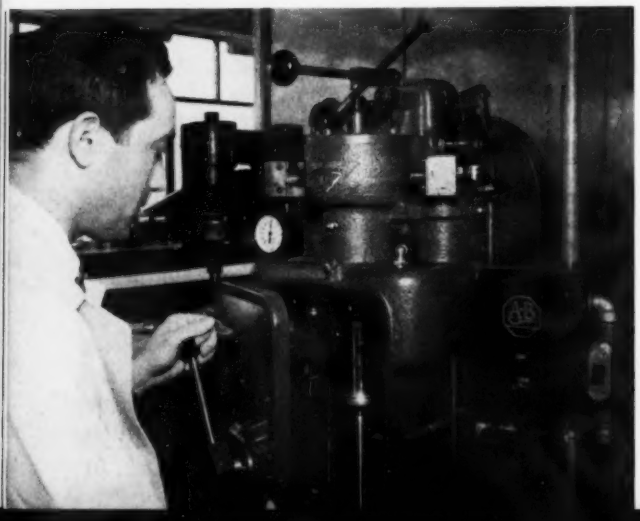
As a result of the outstanding facilities that have become available with the completion of the John Thompson Dorrance Building and the numerous donations of special equipment presented to the Department during the past year, progress on many fronts is expected. Through the generosity of several outstanding companies in the refrigerated-warehouse industry, for example, the Department now has one of the best refrigeration centers for food research available in any American university, and this center is being devoted to problems associated with food preservation.

A list of the organizations that have become sponsors of various phases of our activities presents the appearance of a Blue Book of organizations having a national interest in foods and in accessory organiza-

tions in the packaging field. During the period since its establishment, the Department has had the following among its sponsors and donors of fellowships or equipment:

American Can Company, New York City
Campbell Soup Company, Camden, N. J.
Cherry-Burrell Corporation, Chicago and Boston
Coffee Brewing Institute, Inc., New York City
Colonial Provision Company, Inc., Boston
Continental Can Company, Chicago
Dehydrating Process Company, Boston
Dewey and Almy Chemical Company, Cambridge, Mass.
Dow Chemical Company, Midland, Mich.
E. I. du Pont de Nemours and Company, Inc., Wilmington, Del.
First National Stores, Inc., Somerville, Mass.
General Foods Corporation, New York City
Gerber Products Company, Fremont, Mich.
Hartford Empire Company, Hartford, Conn.
Institute of Shortening and Edible Oils, Washington, D. C.
Kraft Foods Company, Glenview, Ill.
Lombard Governor Corporation, Ashland, Mass.
Oscar Mayer and Company, Madison, Wis.
Merchants Cold Storage Company, New York City
Merchan's Cold Storage Company, Providence, R. I.
National Dairies Research Laboratories, Oakdale, Long Island, N. Y.
The Nestle Company, Inc., White Plains, N. Y.
The Nutrition Foundation, New York City
Pillsbury Mills, Inc., Minneapolis, Minn.
The Procter and Gamble Company, Cincinnati, Ohio
The Quaker Oats Company, Chicago
Quincy Market Cold Storage and Warehouse Company, Boston
Raytheon Manufacturing Company, Waltham, Mass.
Research Corporation (Williams-Waterman Fund), New York City
Standard Brands, Inc., New York City
Sugar Research Foundation, Inc., New York City
Terminal Ice and Cold Storage Company, Portland, Ore.
United Fruit Company, New York and Boston
The Upjohn Company, Kalamazoo, Mich.
Wilson and Company, Chicago

M.I.T. Photo



Recently arrangements have been made for graduate fellowships, which have been sponsored by the following organizations: American Chicle Company, Long Island City, N. Y.; Armour and Company, Chicago; Gerber Products Company, Fremont, Mich.; Procter and Gamble Company, Cincinnati, Ohio; The Roche Anniversary Foundation, Montclair, N. J.; and William Underwood Company, Watertown, Mass.

At the present time substantial research projects are being conducted in co-operation with the Subsistence Division of the Quartermaster Corps of the United States Army, the Bureau of Supplies and Accounts of the U.S. Naval Supply Depot, the U.S. Atomic Energy Commission, the National Institutes of Health, the Bureau of Agricultural and Industrial Chemistry of the Agricultural Research Administration, U.S. Department of Agriculture, and others.

In the period of less than a decade during which our activities in food technology have been conducted, our staff have presented and published more than 150 papers in various scientific journals. A bibliography of these papers has been prepared, and copies of this bibliography are available, upon request.

In addition to these papers, a considerable number of textbooks and research volumes have been published, with various members of our Department as their authors.

Trends in Food Products

Perhaps there is no greater indication of the important place that food technology has taken in the business of this nation than the survey published in October, 1953, by *Fortune*. This survey indicates that during the past decade our population has tremendously increased its expenditures for foods and that most of this increase, above that attributed to rising prices, was due to the tremendous influx of products prepared and packaged for the convenience of the homemaker. That this trend will continue in the future and provide a most fertile field for men properly trained in food technology is well established. Food products now represent a sixty billion dollar annual market, and the curves are still trending upward. So for those who are particularly trained in the making of more convenient foods, more nutritious foods, more attractive foods, and safer foods, there appear to be plenty of challenges ahead. Many of these challenges mean new processes, and it is with such activities that our staff, graduates, and students are concerned.

Limitations of space prevent a detailed exposition of all the activities of the Department of Food Technology. However, we wish to emphasize particularly that we shall welcome the visits of Alumni with common interests and shall be happy to have the opportunity of discussing any joint fields of interests more in detail with any individuals who care to visit our new home. We shall also welcome the opportunity of discussing our activities with able young men who agree with us that food technology has real promise as a professional field in the future.

Facilities on a pilot model scale such as this vacuum can-sealing equipment are used for the most modern canning operations in the Food Technology Laboratories at M.I.T.

THE INSTITUTE GAZETTE

PREPARED IN COLLABORATION WITH THE TECHNOLOGY NEWS SERVICE

To the Webster Chair

PROFESSOR ARNOLD TUSTIN, distinguished British engineer and Head of the Department of Electrical Engineering at the University of Birmingham, England, has been invited to occupy the Webster Chair of Electrical Engineering as a visiting professor at the Institute for the academic year 1953-1954. The Webster Chair of Electrical Engineering was established in 1952 by the Edwin Sibley Webster Foundation, in memory of the late Mr. Webster (Class of 1888), one of the Institute's most distinguished Alumni.

Professor Tustin will participate in the development of teaching and research in the applications and uses of electric power. He was graduated from the University of Durham in 1920. Professor Tustin had had extensive and varied experience in the electrical manufacturing industry before first entering the academic field at Birmingham seven years ago. He was previously assistant chief engineer at the Sheffield Works of the Metropolitan-Vickers Electrical Company.

Professor Tustin has mainly been associated with developments in the design of electrical machines, particularly of special direct-current machines. He specialized in electric traction and played an active part in the development that consolidated the use of 1,500- and 3,000-volt direct current as standard systems that produced the modern lightweight trolleybus motor.

During World War II, he was involved in the development of the Metadyne, a method of control, for such applications as the automatic laying of antiaircraft guns, and in the development of the gyroscopic stabilizer for guns in tanks.

He hopes during his stay at M.I.T. to develop further his analysis of the combination of technical and general education that is called for by the social needs of the future.

Associate Head, Lincoln Laboratory

GEORGE E. VALLEY, JR., '35, Associate Professor of Physics at the Institute, has been appointed associate director of the Lincoln Laboratory, an electronic research project operated by M.I.T. for the Department of Defense.

Born in New York City in 1913, Dr. Valley received the degrees of bachelor of science at M.I.T. in 1935 and doctor of philosophy at the University of Rochester in 1939. He then served at Harvard University as a research assistant (1939-1940) and as a National Research Fellow (1940-1941). In 1941, Dr. Valley joined the staff of M.I.T.'s Radiation Laboratory and later served as technical editor of the Laboratory's Office of Publications. Appointed assistant professor of physics at M.I.T. in 1945 and associate professor in 1949, Dr. Valley has specialized in nuclear physics and cosmic radiation.

Centenarian

WILLIAM PRESTON ATWOOD, 57 Kingswood Road, Auburndale 66, Mass., oldest living Alumnus of the Institute, celebrated his 100th birthday at a reception at his home on Sunday afternoon, October 25. Mr. Atwood, a member of the Class of 1876, reached the 100-year mark on Tuesday, October 27, 1953. Approximately 60 members of the Atwood family, friends, and neighbors called to pay respects to this man whose life span encompasses the entire history of M.I.T.

An important part of the Sunday afternoon reception was the presentation to Mr. Atwood of congratulatory letters from Karl T. Compton, Chairman of the M.I.T. Corporation, James R. Killian, Jr., '26, President of M.I.T., and Horatio L. Bond, '23, President of the M.I.T. Alumni Association. These letters were read to Mr. Atwood by his son, William F. Atwood, '21, also of Auburndale.

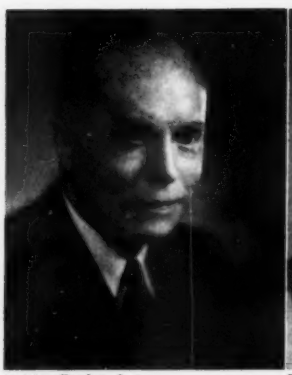
Born in Orrington, Maine, on October 27, 1853, William Preston Atwood spent his entire professional life as chemist in the textile industry. He entered M.I.T. from Lowell in 1872, and was graduated from Course V (Chemistry) with the Class of 1876. Following his graduation from the Institute, Mr. Atwood became chemist for the Hamilton Print Works in Lowell, which firm changed its name to the Hamilton Manufacturing Company in 1905. In 1909 Mr. Atwood was chemist for the Massachusetts Cotton Mills of Lowell, becoming head chemist for that firm several years later. He retired in 1928 and lived in Chelmsford until a few years ago when he moved to Auburndale where his son and daughter reside.

Mr. Atwood has been in good health throughout his long life, and retains interest in current events. He enjoys radio and television programs, and was watching a television program when guests arrived to attend his reception.

Extending official congratulations to William P. Atwood, '76, at his 100th birthday are (at left) Horatio L. Bond, '23, and (at right) William F. Atwood, '21, a son.

M.I.T. Photo

New Life Members of M.I.T. Corporation



Fabian Bachrach

Thomas D'A. Brophy, '16

Fabian Bachrach

William A. Coolidge

Fabian Bachrach

Lloyd D. Brace

Bell Telephone Laboratories, Inc.

Mervin J. Kelly

Corporation News

ELECTION of four life members to the Institute's Corporation was announced last August by James R. Killian, Jr., '26, President of M.I.T. The new life members are: Lloyd D. Brace, President and Director of the First National Bank of Boston; Thomas D'A. Brophy, '16, Chairman of the Board of Kenyon and Eckhart, New York advertising agency; William A. Coolidge, President of New Enterprises, Inc. (Boston); and Mervin J. Kelly, President of the Bell Telephone Laboratories of New York .

Mr. Brace has been with the First National Bank of Boston since 1925; he is also president and director of the First of Boston International Corporation; trustee of the Boston Five Cents Savings Bank; and director of the National Life Insurance Company, the Gillette Safety Razor Company, and the U.S. Smelting, Refining and Mining Company.

Born in Lincoln, Neb., in 1903, Mr. Brace was graduated from Dartmouth College in 1925 and now makes his home in Needham, Mass. He is chairman of the Board of Boys and Girls Camps, Inc., and trustee and member of the Finance Committee of the Massachusetts General Hospital and for Phillips Academy at Andover, Mass.

Mr. Brophy has been chairman of the Board of Kenyon and Eckhart, Inc., of New York and Kenyon and Eckhart, Ltd., of Montreal since 1949. From 1937 to 1949 he was president of the firm.

Born in Butte, Mont., in 1893, he received the degree of bachelor of arts from Gonzaga College (Spokane, Wash.) in 1912, and the S.B. degree from the Institute in 1916.

Mr. Brophy has served as vice-president and director of the American Association of Advertising Agencies and as president of the American Heritage Foundation. He is a resident of Scarsdale, N.Y.

Mr. Coolidge, who became president of the New Enterprises, Inc., in 1946, is also chairman of the Board of the National Research Corporation; president and director of Orange Concentrates Associates, Inc.; and director of the Nopco Chemical Company and the Infra Roast Corporation.

Born in Boston, he studied at St. Mark's School and received the degree of bachelor of arts *cum laude* from Harvard in 1924. He also holds the degree of master of arts from Balliol College, Oxford. Mr. Coolidge, a resident of Topsfield, is a trustee of St. Mark's School and the Boston Lying-in Hospital.

Dr. Kelly has been associated with the Bell Telephone Laboratories since 1925. He served as executive vice-president from 1944 until 1950 when he became president.

Born in Princeton, Mo., in 1894, he received the degree of bachelor of science from the Missouri School of Mines and Metallurgy in 1914, the M.S. degree from the University of Kentucky in 1915, and the Ph.D. degree from the University of Chicago in 1918. In October, Dr. Kelly was named to receive the Industrial Research Institute Medal for 1954. He is a resident of Short Hills, N. J.

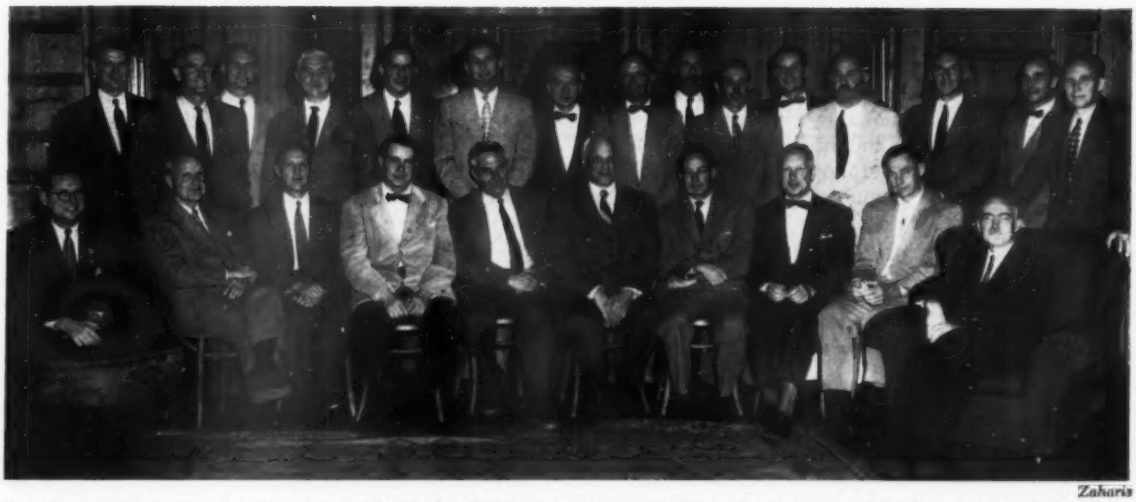
T.C.A. General Secretary

IN September, Robert J. Holden, prominent Unitarian minister and leader in civic affairs in New Bedford, became general secretary for the Technology Christian Association at M.I.T. As general secretary, Mr. Holden will have administrative responsibility for the T.C.A.'s diversified program of service to the M.I.T. student community. He will work very closely with William Speer, Associate Dean of Students, in planning for the use of M.I.T.'s new auditorium and chapel. Mr. Holden had the gratifying experience of working in Cleveland as assistant to the late Everett M. Baker, former Dean of Students at M.I.T.

Mr. Holden will succeed Wallace M. Ross, T.C.A. general secretary since 1934, whose retirement was announced in the July, 1953, issue of The Review. Mr. Ross will continue a part-time association with the Technology Christian Association.

Mr. Holden was born in Natick, Mass., and attended the Natick public schools. He was graduated from Albion College in Albion, Mich., in 1939, and from the Harvard Divinity School in 1942. He has been minister of the First Congregational Society (Unitarian) in New Bedford since 1946, when he returned from service as a chaplain with the U.S. Navy.

Mr. Holden has been active and held several assignments in the American Unitarian Association. He has been chairman of the Teacher Training Institute for the New England region and of the Leadership Training Committee of the Division of Education.



Zaharis

For the second year, administrative heads of the California Institute of Technology and of the Massachusetts Institute of Technology discussed problems of mutual interest in the educational field in a week-end conference. Last year half a score of Technology administrative heads were guests of the California Institute of Technology. This year, 10 C.I.T. executives came east to attend a conference at Castle Hill near Ipswich, Mass. for the week end of October 10-13, followed by visits to M.I.T. Photographed at the gathering at Castle Hill (front row, left to right) are: Edwin R. Gilliland, '33, Earnest C. Watson, C.I.T., William N. Lacey, C.I.T., James R. Killian, Jr., '26, Lee A. DuBridge, C.I.T., Karl T. Compton, Robert F. Bacher, C.I.T., Julius A. Stratton, '23, Robert P. Sharp, C.I.T., and George R. Harrison; (rear row, left to right) Malcolm G. Kispert, 2–44, George W. Beadle, C.I.T., Joseph J. Snyder, 2–44, E. P. Brooks, '17, Dr. Dana L. Farnsworth, G. W. Green, C.I.T., Harold L. Hazen, '24, H. D. Smith, C.I.T., Pietro Belluschi, J. R. Weir, C.I.T., E. Francis Bowditch, H. P. Robertson, C.I.T., B. Alden Thresher, '20, Patrick M. Hurley, '40 and Harold E. Edgerton, '27.

Appointments and Promotions

AMONG Faculty advancements and appointments this fall was the appointment of John F. Reintjes, Associate Professor of Electrical Communications, to the post of director of the Servomechanisms Laboratory of the Department of Electrical Engineering. Professor Reintjes succeeds William M. Pease, '42, Associate Professor of Electrical Engineering, who resigned to begin a career in industry.

Two men have been promoted to the rank of associate professor and seven to the rank of assistant professor, with new appointments including three visiting professors, four associate professors, and nine assistant professors as named below:

Major Edgar W. Nichols of the Department of Air Science and Tactics, and Major Charley W. Haynes of the Department of Military Science were promoted to associate professor.

Promoted to the rank of assistant professor are: William J. LeMessurier and Robert V. Whitman, '49, both in the Department of Civil and Sanitary Engineering; Henry C. Bourne, Jr., 2-44, and Leonard A. Gould, '48, both in the Department of Electrical Engineering; Ralph W. Gretter, '50, Department of Mechanical Engineering; Douglas W. Fuerstenau, Department of Metallurgy; and Sidney D. Drell, Department of Physics.

Visiting professors newly appointed include: Don M. Yost, Arthur D. Little Visiting Professor in Chemistry; Daniel Lerner, Department of Economics and Social Science; and J. G. Yates, Department of Electrical Engineering.

Four new associate professors are: William A. W. Krebs, Jr., and Joseph A. Pechman, School of Industrial Management; Major William J. Keating and Major William Mattis, Department of Military Science.

Nine appointments to assistant professorships include: Norman Beecher, 2-44, School of Chemical Engineering Practice; Ross E. McKinney, '49, Department of Civil and Sanitary Engineering; Peter Elias, 2-44, and David A. Huffman, Department of Electrical Engineering; Lacy B. Smith, Department of Humanities; Thomson M. Whitin, School of Industrial Management; Robert W. Mann, '50, Department of Mechanical Engineering; Major Douthit L. Furches, Department of Military Science; and Elmer E. Allmendinger, Department of Naval Architecture and Marine Engineering.

Registration 1953-1954

A TOTAL of 5,129 students registered for the opening of the current academic year at the Institute, according to figures released on October 20 by Joseph C. MacKinnon, '13, M.I.T. Registrar. This total represents an increase of 55 students over last year's registration. However, these are tentative figures subject to correction as late registrations are tallied.

This year's Freshman Class numbers 843, compared with 937 in the entering class one year ago. Among the undergraduate groups only this year's Sophomore Class, numbering 921, is larger than the corresponding group of the 1952-1953 academic year. The tentative registration figure of 1,924 graduate students marks a new high in the history of M.I.T.

The Department of Electrical Engineering continues to enroll the largest number of M.I.T. students – this year 628 undergraduate and 375 graduate students for a total of 1,003. The Departments of Me-

chanical Engineering and of Chemical Engineering follow with 602 and 553 respectively.

Though the decision is not binding, M.I.T. freshmen are asked when they first register at M.I.T. to indicate the field in which they expect to study. Electrical Engineering was the most popular selection of this year's entering class, followed by Chemical Engineering, Mechanical Engineering, and Physics in that order.

Financial Review

JOSEPH J. SNYDER, 2-44, M.I.T. Treasurer, reported to the Corporation at its meeting on October 5 that in the fiscal year 1952-1953 every major source of revenue of the Institute increased over the level of the preceding year. The total volume of operations was $43,036,000 as compared with $32,518,000 in 1951-1952, $23,469,000 in 1950-1951, and $21,470,000 in 1949-1950. The continued growth in the scale of operations in the past two years has been due very largely to the expansion in the contract research of the Division of Defense Laboratories.

The combined volume of academic operations and auxiliary activities was $9,921,000 for the year, showing an increase from $9,029,000 in 1951-1952. After declining for three successive years, tuition income increased to $3,751,000 from $3,628,000. To meet current expenses, gifts and other receipts were used in the amount of $2,985,000. This source of income was drawn on more heavily than in recent years with gifts and receipts used in 1951–1952 at $2,433,000 and in 1950–1951 at $2,183,000.

On June 30, 1953, the invested and other funds of the Institute were $63,833,000 at book value and on June 30, 1952, the funds were $60,632,000. The net increase in the funds during the year of $3,201,000 is comparable with the increases of $3,814,000 in 1951-1952 and $4,135,000 in 1950-1951. For the year the net increase consisted of increases of $1,249,000 in general purpose endowment, $1,154,000 in endowment for designated purposes and $798,000 in other classes of funds. The Faculty Salary Fund was increased by $1,014,000 to $4,115,000 and this was the principal change in endowment for general purposes. Funds for research of $566,000, for student aid of $329,000, and for professorships of $237,000 were added to endowment for designated purposes during the year. A substantial part of the funds of the Institute are temporarily invested or included with current assets that may be withdrawn and these funds were 27 per cent of all funds on June 30, 1953. On the same date, 73 per cent of the funds were endowment funds or funds functioning as endowment.

The book value of the plant of the Institute was $33,065,000 on June 30, 1953, and $31,365,000 on June 30, 1952. Construction during the year included the completion of the John Thompson Dorrance Building and the extension and renovation of the steam supply lines to the west campus as the main additions to educational plant assets.

The gifts, grants, and bequests received during the year were $5,982,000, and in the year before $6,953,000 was received by the Institute. Included in the gifts for the year was $1,780,000 in payments toward subscriptions to the Development Program pledged from 1948 to 1951. The bequest of Katie M. A. Grimmons, mother of John A. Grimmons, '21, for scholarships, the bequest of Gertrude Newman, wife of A. Parker Newman, '92, for student aid, and further payments for the Edwin Sibley Webster ('88) Professorship by the Webster Foundation made up the greater part of the endowment receipts for designated purposes of $538,000. The second distribution from the Estate of Mrs. H. Sylvia A. H. G. Wilks of $818,000 and a third payment from the Ford Motor Company Fund were included with invested gifts for general purposes of $1,404,000. The Alumni Fund which increased to $189,000 from $122,000 last year and a grant of $500,000 from the Rockefeller Foundation for research in biology were gifts received and classified with invested funds for designated purposes of $1,109,000. Contributions received from the Alfred P. Sloan ('95) Foundation for the School of Industrial Management were $745,000 and for other purposes $132,000. Gifts for unrestricted purposes of $1,122,000 were added to general endowment, and gifts of $540,000 for designated purposes with principal available for immediate expenditure were added to endowment for designated purposes during the year.

The investments of the Institute had a book value of $59,940,000 and a market value of $73,080,000 on June 30, 1953. The distribution of the general investments at market values in bonds, common stocks and real estate changed very slightly during the year. The investment in bonds increased to 29.5 per cent from 27 per cent, with a reduction in government securities and an increase in other bonds. Common stocks decreased to 45.1 per cent from 46.9 per cent and real estate increased to 17.0 per cent from 15.6 per cent of the general investments.

Forty-eight per cent of the additions to plant and 64 per cent of the increase in endowment since 1948 has been made possible through the use of unrestricted resources. By minimizing the use of unrestricted funds in meeting current operating expenses, gifts for endowment have been supplemented and further progress made in securing the endowment capital required to stabilize operations of the Institute.

Million Dollar Defense

HORATIO L. BOND, '23, President of the Alumni Association, opened the 298th meeting of the Alumni Council at the M.I.T. Faculty Club on Monday, October 26, 1953. The 159 members and guests present made this first meeting of the season the largest Alumni Council on record. Principal speakers at the meeting were: James R. Killian, Jr., '26, President of the Institute; and Horace S. Ford, Acting Director, Division of Defense Laboratories.

Charles E. Fuller, '92, Professor of Theoretical and Applied Mechanics, Emeritus, presented the report of the Committee on Resolutions for the late Fred E. Bedlow, '85. President Bond called upon the members present to accept the resolutions by silent rising vote.

Last June's successful Alumni Day was conducted with an operating overhead to the Association of $3,541, compared with the previous year's overhead

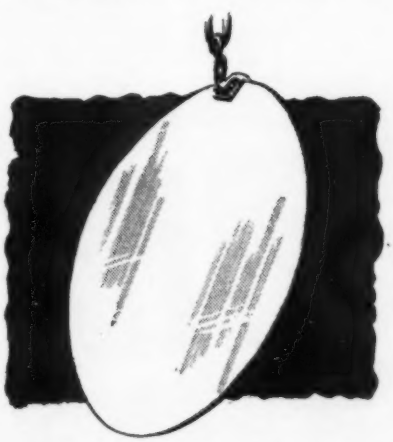
(*Continued on page 100*)

BUSINESS IN MOTION

To our Colleagues in American Business . . .

Revere, like other companies, prefers to avoid rush orders, because they tend to upset orderly scheduling of production and shipment. However, we are not bound by system, and will do everything we can to help when a customer faces a genuine emergency. Sometimes, of course, in spite of the best will in the world, we encounter conditions beyond our control. A metal shortage is one example. But when there is an overwhelming need for speed sometimes we can meet it.

Let us cite a recent case. An important customer on the West Coast had spoiled two circular tube sheets while drilling them. This message was relayed by telephone to our New Bedford mill where we produce these sheets. How soon could we replace them? They were for an important government project. So urgent was the need that the customer offered to charter a plane to fly them to California as soon as they were ready.



A quick check showed that we could make duplicate sheets much more quickly than usual. The specified alloy was in stock, partially processed, so that casting time was eliminated, as well as some of the rolling. It was rolled down to the required gauge, 1⅛ inch thick, leveled, and cut into two circles, each 98 inches in diameter.

Meanwhile, the Traffic Department worked on the rather complicated problem of determining the fastest, most direct, yet least expensive way to get the circles to the Coast. Because of the weight and the time already saved, shipping by plane entailed a cost that didn't seem justified. Traffic reported that the best solution was to ship by "direct car," which guaranteed no extra handling or trans-shipping en route. This was agreed to by the customer, and four days after he called us, the circles were thus shipped. They arrived eleven days later, in time to meet the deadline.

Was the extra effort required to rush through 5,000 pounds of tube sheets justified? We are sure it was. Two days after the circles arrived we received a letter from the customer, in which he said: "The promptness with which your company undertook the problem of supplying the two sheets to replace those we had spoiled has been appreciated by all of us. . . . It is most heartening to work with persons who have a real sense of responsibility and concern over their customers' emergency requirements. Your company's performance in this instance left nothing to be desired and we want you to know that it meant a great deal to all of us."

As we have remarked, we do not relish rushes any more than anybody else, but when there is a situation of real gravity, we will do our best to cope with it. Other suppliers in all industries, we have observed, follow much the same policy, so we suggest that when a genuine emergency arises, tell your suppliers the exact nature of it and ask them what they can do for you. They may be able to find a way to help you, as Revere did in the case just cited.

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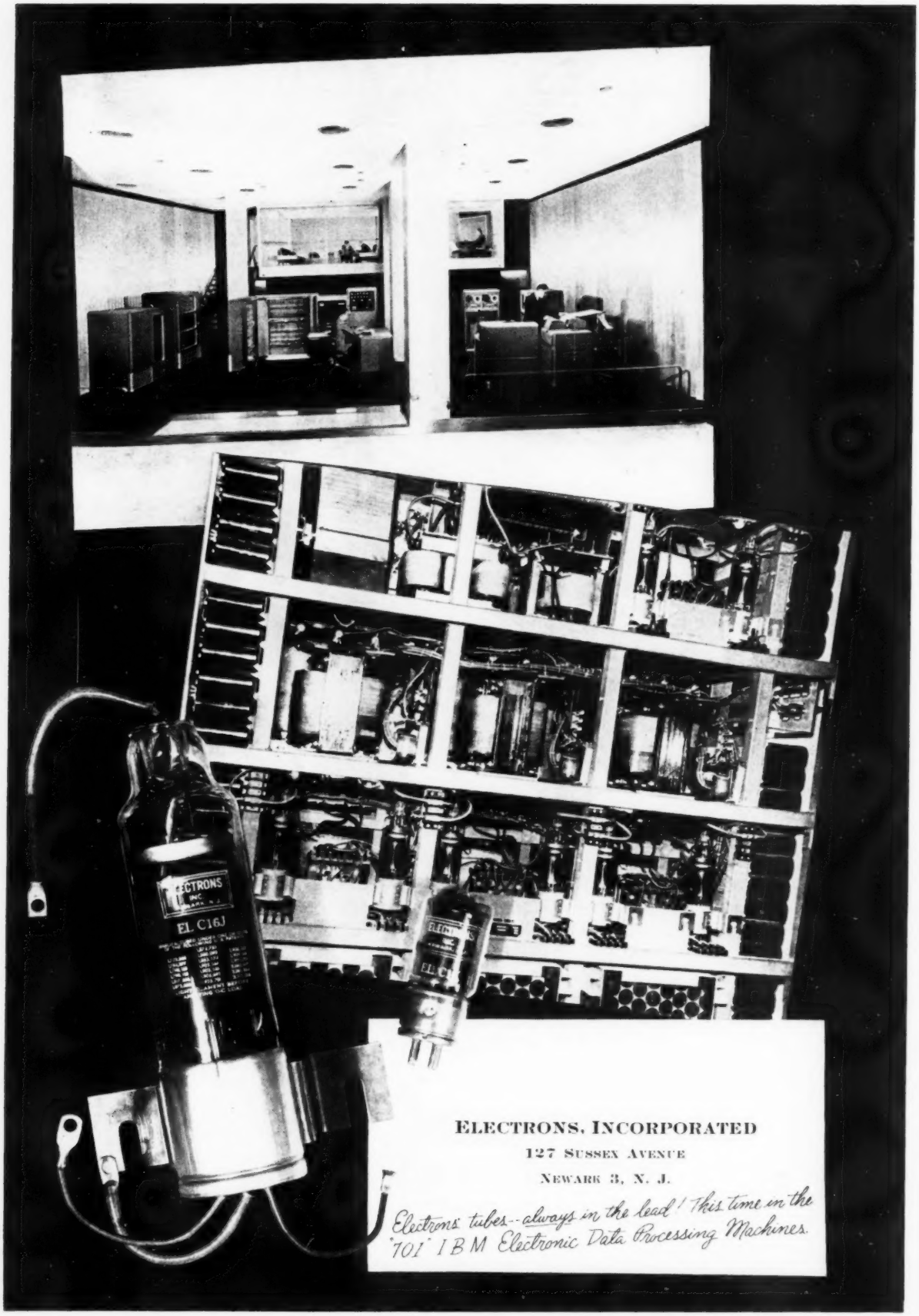

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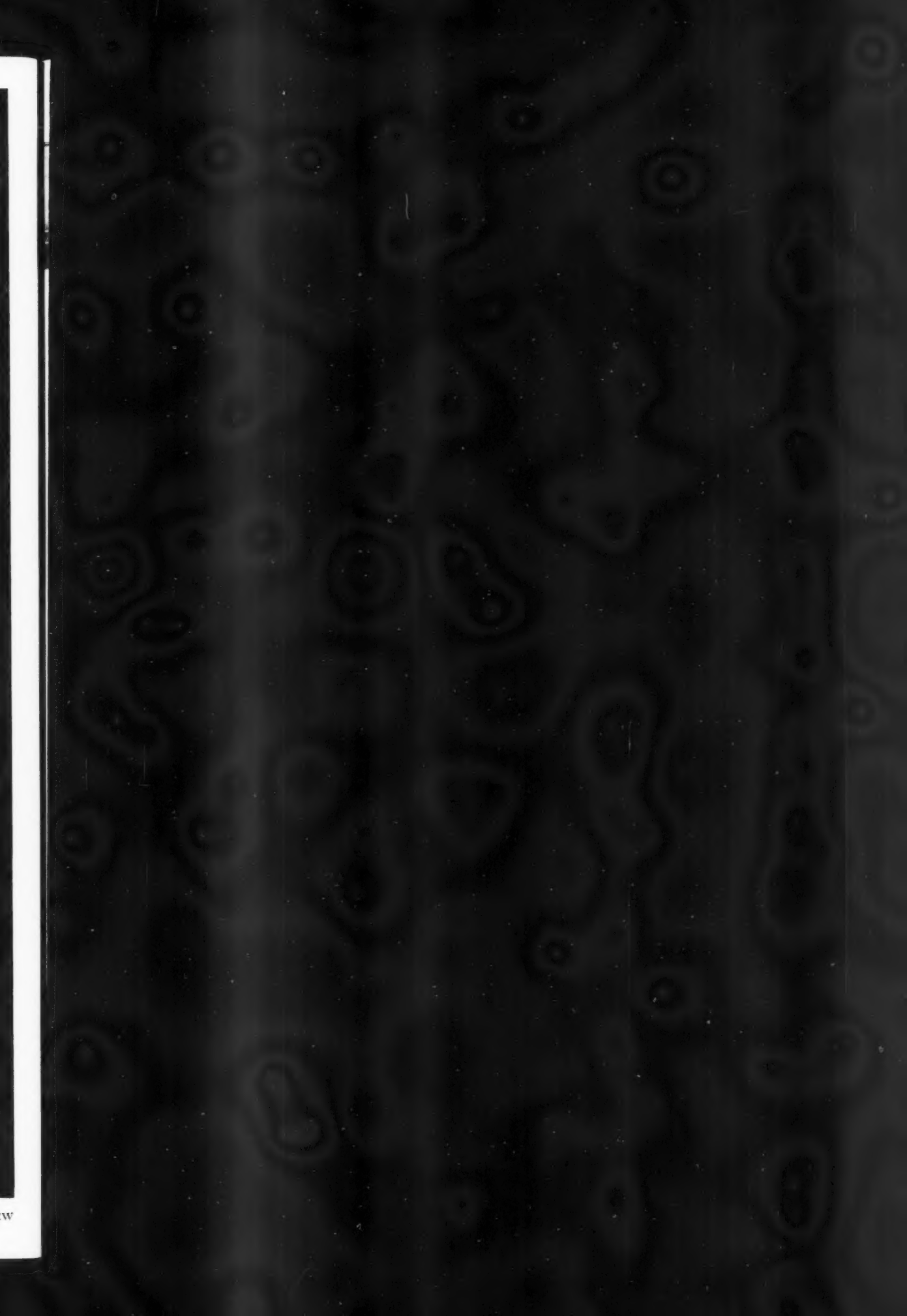

Lafayette Elementary School, Waterloo, N. Y. Completed 1951 at a cost of $550,000. Architect and Engineer: Carl C. Ade. Heating Contractor: A. Burgart, Inc.

COLD MEETS ITS WATERLOO

In Waterloo, New York

New York Community Modernizes its School System With New Schools and Tru-Perimeter Heating

When Waterloo, N. Y., decided its educational shoe was pinching they called on Carl C. Ade, prominent Rochester architect and engineer, to help remedy the situation.

Result – the handsome new Lafayette Elementary School illustrated here and the even larger Skoi-Yase (Indian for 'bubbling water') Elementary School now under construction. With these new schools, and its existing buildings, Waterloo has solved its educational space problems for many years to come.

For efficient, modern heating, both these new schools use Webster Walvector, as do many of the schools designed by Carl C. Ade's office.

Here is Tru-Perimeter Heating. The cold perimeter walls of the buildings are heated gently and evenly. There are no cold spots, no hot spots, no drafts. With Webster Walvector, the heating element and piping are concealed in attractive metal enclosures.

Webster Walvector in perimeter heating simplifies piping, uses fewer risers. Heating up is quick, effectively controlled. Buildings can be heated just before occupancy and the heat reduced immediately after the need is gone.

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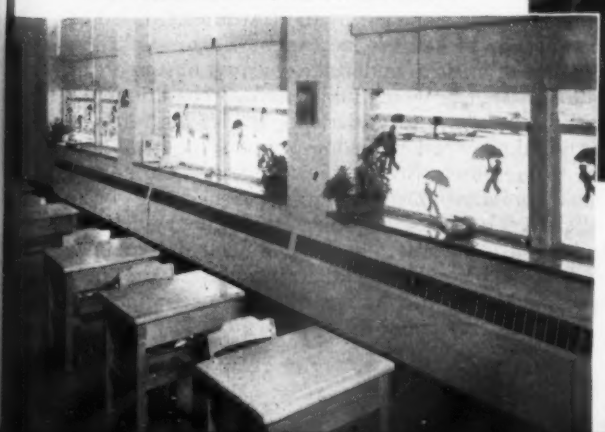
District #3, Irondequoit;
Pittsford Jr.-Sr. High School, Pittsford;
Griffith Institute, Springville;
Bryant School, Hornell;
Lafayette School, Waterloo;
Skoi-Yase School and Bus Garage, Waterloo;
Webster Central School, Webster;
West Webster Elementary School, West Webster

Above: Kindergarten of the Lafayette School. Here concealed Webster System Radiators deliver heat through top outlet grilles shown in window sills. Air enters below toy shelving.



Left: Webster Walvector under windows in Lafayette School classroom. Air enters below Walvector enclosure, is gently warmed by heating element and passes out through the attractive grilles. Wall-to-wall warmth, no cold spots.

BARNSTEAD
WATER DEMINERALIZERS
are
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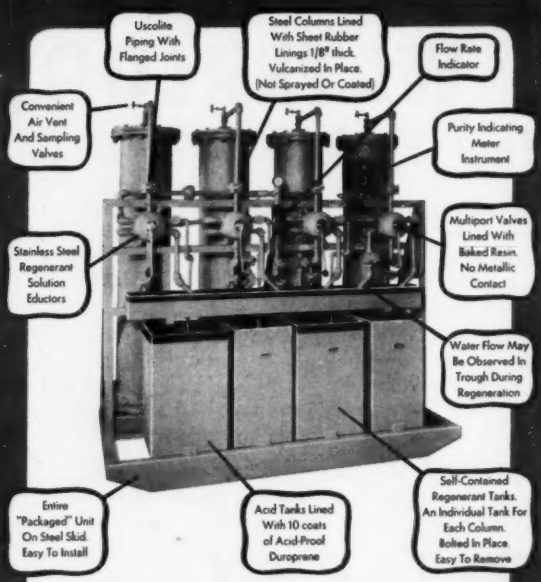
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THE INSTITUTE GAZETTE

(*Continued from page 96*)

cost of $3,826. The Alumni Association closed its fiscal year on June 30, 1953, with an unexpended balance of $307. This sum, together with the $9,360 profit to the Association from last year's Volume LV of The Review, is being turned over to the 1953-1954 Alumni Fund.

Donald P. Severance, '38, Secretary, announced that a manual for class officers is about to be distributed to all elected class officers, Alumni Fund class agents, and reunion chairmen. Anyone wishing a copy of the manual may obtain one from Mr. Severance.

Edwin D. Ryer, '20, last year's President of the Alumni Association, was at this time presented a gavel by President Bond, as a souvenir to remind him of the many successful M.I.T. alumni meetings over which he had presided in 1952-1953 — a reminder of a very successful year as president, much appreciated by those who worked with him and all others who enjoyed the benefit of his presidency.

Following an introduction of the new members of the Council, Dr. Killian was introduced as the first speaker. President Killian opened his remarks by referring to this fall's student registration which is slightly larger than last year's; spoke of the arrangement by which last March members of M.I.T.'s Academic Council consulted with their counterparts on the campus at California Institute of Technology and this year the similar group has just completed a five-day visit from C.I.T. with members of the M.I.T. Faculty and Administration here in Cambridge; and mentioned the "Andover Conferences" which have been bringing together Faculty members and administrative officers for uninterrupted week ends of free exchange of ideas away from the Institute during the past two years, citing particularly the "Andover Conference" of the week end of October 24 when a similar very successful meeting included leaders of the student organizations.

In connection with the principal topic of the evening, namely the Division of Defense Laboratories and Lincoln Laboratory, President Killian stressed the enormous load of work for the government being done by members of the Faculty and Administration for which neither they nor M.I.T. receives compensation — a figure informally set at $1,000,000 a year. He gave a rough breakdown of the $43,000,000 total in 1952-1953 of M.I.T.'s academic budget and budgets of research projects managed by the Institute. This led to the question of M.I.T.'s inescapable responsibility in this time of crisis to undertake research in support of national security which under normal conditions we would choose not to undertake. Dr. Killian referred to the Administration's endeavor to find ways to manage this research without detracting from our educational program. Dr. Killian mentioned the basic differences between the projects under the Division of Industrial Coöperation and the Lincoln Laboratory. With this, President Killian introduced the next speaker, Mr. Ford, who returned from retirement to

(*Continued on page 102*)

molecules **FROZEN** in their tracks

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At normal temperatures the molecules of matter are in constant, random motion. This chaotic condition practically ceases when matter is frozen in liquid helium. A temporary state of "order" is created which is ideal for research in the fundamental behavior of matter. Almost daily, cryogenic research is revealing new and startling phenomena to increase our understanding of metals, crystals, liquids, gases, of electrical resistance and induction. New superconductors of electricity, screens against magnetism, new communications and control processes, appear to be at the threshold of practical application to industry.

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(*Continued from page 100*)

accept the responsibility of acting head of the D.D.L.

Mr. Ford opened his presentation with the startling announcement that M.I.T. and the California Institute of Technology are the only educational institutions in the country with more persons on the payroll than students enrolled, a statement easy to understand in the light of a $9,000,000 academic budget and a $34,000,000 sponsored research budget last year for M.I.T.

He traced the history of M.I.T.'s sponsored research from the first Research Laboratory of Applied Chemistry started by Arthur D. Little, '85, Professors William H. Walker, and Warren K. Lewis, '05, through the Division of Industrial Coöperation whose budgets never exceeded $100,000 annually until 1940. Mr. Ford's figures showed the rise and fall of the sponsored research budgets from $1,300,000 in 1941, to last year's $34,000,000 through the war years, the immediate postwar period, and the present period of military urgency. He mentioned that the willingness of the Institute following World War II to accept large sponsored research projects had made it possible greatly to increase M.I.T.'s contributions to the nation, and had enabled M.I.T. to create the Lincoln Laboratory and similar projects. In speaking of Lincoln Laboratory, which is operated by M.I.T. for the three branches of the military service and which is devoted to the technical aspects of air defense, he recommended the reading of "For a Continental Defense" by President Killian and Professor Albert G. Hill, Director of Lincoln Laboratory, which appears in the November, 1953, issue of the *Atlantic Monthly*. Mr. Ford told of the inauguration of the D.D.L. for the purpose of segregating such classified military research from the educational activities of the Institute, to afford specialized fiscal management of large off-campus sponsored research, and particularly to provide for Lincoln Laboratory.

Mr. Ford described the function of this Division with respect to personnel, property, security, and fiscal relations — and took this opportunity to introduce Paul V. Cusick, Associate Director, and Henry W. Fitzpatrick, Assistant Director.

Laboratory of Lighting Design

THE establishment of a Laboratory of Lighting Design in the School of Architecture and Planning was announced in September by Professor Lawrence B. Anderson, '30, Head of the M.I.T. Department of Architecture. The laboratory was inaugurated by an initial grant from the F. W. Wakefield Brass Company. The broad program of the laboratory will be a study of all factors of environment which contribute to the process of seeing.

The laboratory's first public event was a seminar on "Vision, Brightness, and Design" which was held on September 23. Fifteen specialists in engineering, illumination, architecture, psychology, and physiology participated in a two-day program.

(*Continued on page 104*)

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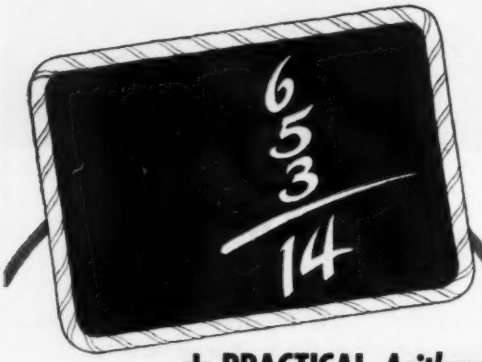

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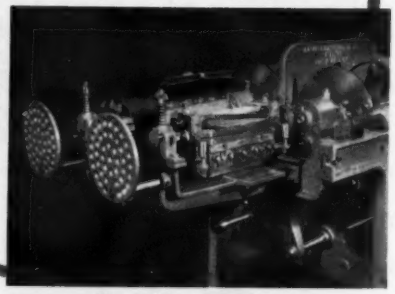

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(*Continued from page 102*)

Mechanical Engineering Standards

THE Visiting Committee on the Department of Mechanical Engineering* met for an all-day session on November 6, 1952, with: James R. Killian, Jr., '26, President; Edward L. Cochrane, '20, Dean of the School of Engineering; Professor C. Richard Soderberg, '20, Head of the Department; and various members of the Department. Minutes of the meeting, which have been summarized below, were made available for publication in The Review on August 6, 1953.

Interest centered on the Graduate School of the Department, and three of the major problems of the School were discussed: (1) the participation of the staff members in graduate education; (2) questions which have arisen on the new degree of Mechanical Engineer; and (3) the large influx of foreign students.

Professor Jacob P. Den Hartog pointed out that at present graduate students participate in the Humanities voluntarily but students admitted from other institutions are required to make up Humanities deficiencies if their undergraduate education in that respect is less than that now specified by M.I.T. Following a discussion on whether a minor program should be wholly or partially devoted to Humanities, Andrey A. Potter, '03, suggested that one of the minor subjects should be compulsory in the Humanities field, and the Committee as a whole concurred.

Because some institutions in the United States have reserved the title of Mechanical Engineer for a semi-honorary degree, there is confusion attached to this name. However, the Institute's present standards for the Engineer's degree are very high, and it was agreed that in time the M.I.T. Mechanical Engineer's degree would find a respected place.

The problem of graduate education for people in industry was brought up by Ronald B. Smith and there was considerable discussion on this subject. Faculty members pointed out that proposals for night school graduate activity would inevitably be associated with a lowering of standards in the Graduate School. President Killian stated that the Institute had elected to offer professional conferences and seminars during the regular academic year, as well as during the summer, and possibly could make a greater contribution to education in industry in this manner than through regular night school work. The Committee expressed the hope that more industrial corporations would give support to graduate study by granting educational leaves of absence.

Members of the staff presented complete reports as follows: Professor Edward R. Schwarz, '21, on the work in Textile Technology; Professor Egon Orowan on the educational program of the New Materials Division; and Professor John A. Hrones, '34, on the situa-

(*Continued on page 106*)

*Members of this Committee for 1952–1953 were: Thomas H. West, '22, chairman, Andrey A. Potter, '03, Walter J. Beadle, '17, John A. Lunn, '17, Charles A. Chayne, '19, H. W. McCurdy, '22, L. K. Sillcox, and Ronald B. Smith.

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THE INSTITUTE GAZETTE

(*Continued from page 104*)

tion confronting the Department in its attempt to synthesize the many activities relevant to manufacturing and production.

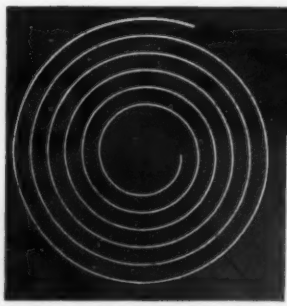
Brief reports on other subjects were given by three associate professors: John E. Arnold, '40, on activities in creative design; William A. Wilson on his experiments with the group project system in laboratory instruction; and William MacG. Murray, '33, on the Co-operative Course, II-B.

President Killian and Professor Soderberg emphatically endorsed the Committee's interest in recognition of good teaching, and described the Institute's continual endeavors to reward effective teaching in its promotions and salary policies, management of research policies, insistence upon participation in creative activity, and so on.

The provision of a Commons Room for the students' leisure and study hours and for meetings and discussions with members of the staff was approved by the Committee. Space is available below the Mechanical Engineering headquarters, and attractive plans have been prepared by students under Professor Arnold's supervision. This plan includes modification of the Department's headquarters into a more effective assembly place. The Committee agreed to sponsor an appeal to Alumni of Course II to obtain the necessary funds for the new quarters, which will be designated as the Edward F. Miller Room, in honor of this distinguished Alumnus of the Class of 1886, and former Head of the Department.

Special tribute was paid by Thomas H. West, '22, the chairman, to the activities of Dr. Potter (M.I.T. Class of 1903), Dean of Engineering at Purdue University, who has served on this Committee for four years. It is sometimes difficult for those concerned principally with industrial activities to offer constructive advice and criticism in the academic field, and an outside point of view from such a distinguished educator as Dean Potter has been wonderfully useful, particularly during the difficult period when the undergraduate curriculum was being revised. He never failed to propose stimulating questions and to offer constructive suggestions for their solution.

(*Continued on page 108*)



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THE INSTITUTE GAZETTE

(*Continued from page 106*)

Plans for Aeronautics

MEETING in the Du Pont Room at M.I.T., members of the Visting Committee on the Department of Aeronautical Engineering* convened on April 14, 1953, with Julius A. Stratton, '23, Vice-president of the Institute, Edward L. Cochrane, '20, Dean of the School of Engineering, and staff members of the Department in attendance. The report of the Committee was received for publication in The Review on July 29, and a summation of some of the important subjects considered by the Committee is presented in the following paragraphs.

A decline in undergraduate enrollment in the Department has taken place in recent years. The practice of personnel representatives from aircraft companies to employ graduates from any and all courses in science and engineering also has tended to discourage enrollment in aeronautics. It is suggested that undergraduate scholarships, provided by interested industrial organizations, would provide an effective stimulus in encouraging young men to think seriously of the opportunities in aeronautical engineering.

The Committee also considered means for keeping staff members abreast of current practice in the industry by direct contact with industrial organizations for continuous periods of several months. The success of such a program of Faculty education in industrial problems requires that the staff include enough members to carry on normal departmental activities while other members are on leave. It was the feeling of the Committee that staff size should be adjusted to make Faculty educational leaves possible in the critical areas where effective teaching is dependent upon knowledge of current industrial practice.

It was brought to the Committee's attention that critical comments have been received on the state of knowledge of Institute graduates in the fields of patents, legal, and budgetary procedures, and other areas in which a practicing engineer must work that are not immediately related to a narrowly technical conception of his responsibilities. It was suggested that much valuable information in this field might be acquired by directed outside reading. The Committee concurs in the opinion that such broader knowledge and background is essential for the high-grade practicing engineer, and recommends that its inclusion in existing courses, at least to the extent of giving adequate direction to outside reading or seminar treatment, be given most serious consideration.

Modern aircraft engineering departments are making extensive use of automatic computing machines in the solution of design problems, and in the reduction of test data. These machines have become such an important and permanent part of modern aircraft en-

(*Concluded on page 110*)

* Members of this Committee for 1952-1953 were: B. Edwin Hutchinson, '09, chairman, Godfrey L. Cabot, '81, Arthur E. Raymond, '21, James H. Doolittle, '24, Lawrence D. Bell, Edward M. Powers, and Gwilym A. Price.

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(Concluded from page 108)

gineering that M.I.T. graduates should have at least been introduced to the techniques of their operation. The Committee was gratified to learn that the fundamentals of analogue computing machinery have already been included in the course structure in Aeronautical Engineering, and that this work reaches into the undergraduate curriculum. However, the analogue computer is only a part of the picture, and graduates going into the fields of design, structures, and aeroelasticity will be only partly prepared unless additional course material is introduced to cover digital computing machinery. The Committee encourages a proposed program involving use of the Institute's punched-card equipment for course work and recommends that it be put into early operation. With regard to the long-term solution to the problem of teaching automatic computing techniques, the Committee is inclined to feel that a modest installation of equipment within the Department and continually available to the students, is far superior to an elaborate computing center used for nonteaching purposes.

Recognizing the close interrelation which exists between the efficiency of aircraft structures and the properties of materials comprising the structures, the Department is now revising its curriculum in structures so that properties of materials can be taught as an integral part of the work in airplane structures. Lack of a universal testing machine to demonstrate properties of aircraft materials and the phenomenon of instability of structural components severely handicaps this program. The Committee concurs with the views of the Department on the teaching of aircraft structural materials, and strongly recommends that the Department be supported in this direction.

Octantal Sphere

LAST July construction was begun on a new auditorium, designed to seat 1,200 people, according to an announcement by Robert M. Kimball, '33, Director of the Institute's Division of Business Administration. The new building, which will occupy a large plot on Memorial Drive a short distance west of Massachusetts Avenue, has been made possible by a gift from the Kresge Foundation. It is expected that the building will be formally open in the fall of 1954.

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BIOLOGICAL SCIENCE

(*Continued from page 86*)

bays on the south side are employed as headquarters for a number of these students. The chief use of these small bays is for the offices and personal laboratories of the professorial staff.

In view of the wide use of instrumentation in the biophysical, biochemical, and physiological research it is imperative that the mechanical shop be adequately equipped with the various types of machines needed and that it be staffed with highly competent instrument makers and machinists. The machine shop, which is located in three large bays in the basement, fully meets these requirements of equipment and personnel. One large bay serves as a shop for the use of graduate students and staff. The Biology Department (David F. Waugh, Associate Professor of Physical Biology, in charge) supervises the work of the shop for both Departments.

Also in the basement is located a branch of the Institute's Office of Laboratory Supplies. It is very handy to students and research staff to have this source of glassware, chemicals, and other supplies readily available in our own building.

Top of the Flight

The animal farm, serving both Departments, is located on the eighth floor and is under the supervision of the Food Technology Department (Professor Robert S. Harris, '28, in charge). Air conditioning of the rooms and the most efficient type of cages for each kind of animal make for the maximum health of the animals. Actually, neither Department uses larger mammals, such as anthropoids, dogs, or cats, to any appreciable extent. Used most extensively are rats, mice, guinea pigs, rabbits, and hamsters. Provision has been made by which cold-blooded animals, such as frogs, turtles, and fish may be kept in an aquarium which occupies one small bay in the basement.

Also located on the eighth floor is a spacious greenhouse equipped with automatic devices for maintenance of proper temperature and humidity. The greenhouse is maintained and operated by the Biology Department (John H. D. Bryan, instructor, in charge). It provides ample space for the growth of plants used in the various courses and cultivated for research purposes. If and when economic botany is undertaken at M.I.T., this greenhouse should prove valuable.

The eighth floor is the highest generally accessible spot at the Institute. On clear days the view is most impressive.

Staff Headquarters and Facilities

Headquarters of the Department are located on the fifth floor on the small-bay side. On either side of the general office are the offices of the Department head and the executive officer. The latter office has for the past three years been occupied by Professor Richard S. Bear, who, in addition to performing the numerous duties of this office most effectively, as well as those of professor of biophysical chemistry, has also been

(*Continued on page 114*)

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BIOLOGICAL SCIENCE

(*Continued from page 112*)

space officer for the Department for the past eight years. It was his job not only to co-ordinate the plans of the various staff members for their respective quarters in the new building but to transmit these plans to the architects and supervise the move from the old to the new quarters.

The design and use of the Department's portion of the building reflects the major research interests of the staff: the application of physical and chemical methods in the solution of biological problems. The approach is analytical in nature and has been expressed as "biology at the molecular level."

One of the most significant aspects of molecular biology is the determination of the molecular structure of tissues and their constituents. For this purpose superb equipment has been assembled, including: electron microscopes (two in the author's group and two for the group of Cecil E. Hall, '48, Associate Professor of Biophysics, both on the fifth floor); polarization and phase contrast optics (in several laboratories); x-ray diffraction (in Professor Bear's group on the seventh floor are four units designed for various types of work); and spectroscopy (located on the seventh floor). For the determination of the shapes, sizes, and properties of large molecules in solution, physical chemical equipment has been assembled, including ultracentrifuges, electrophoresis, viscosity, diffusion, streaming birefringence, and light scattering. This equipment is concentrated on the third floor and is under Professor Waugh's direction. Problems of instrumentation, particularly of an electronic nature, are dealt with by the group under Professor Kurt S. Lion, Associate Professor of Applied Biophysics, on the seventh floor. Each of these specialized pieces of equipment requires special services and laboratory design.

With the investigation of the molecular machinery of tissues it is equally important to study the biochemical processes by which chemical energy is made available to the molecular effectors of the cell and the processes by which the complicated substances — proteins, carbohydrates, lipids, nucleic acids, and so on, are synthesized. These aspects are dealt with by members of the Division of Biochemistry and by the

(*Continued on page 116*)

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BIOLOGICAL SCIENCE

(*Continued from page 114*)

group under Irwin W. Sizer, Associate Professor of Physiology, on the sixth floor. I shall not dwell in detail upon the Division of Biochemistry, for this is discussed in the accompanying article, "Biochemistry at M.I.T.," (page 87) by Professor John M. Buchanan, who is in charge of the Division. However, I shall take this opportunity to indicate my own pleasure at the establishment of this Division within the framework of the Biology Department under a man so highly endowed professionally and personally as Jack Buchanan.

The Divisional Idiom

Some explanation of the divisional idiom may be warranted. The fields which have thus far received major emphasis in the Department are biophysics, biochemistry, and cell physiology. Teaching and research in these fields have been done by individual staff members; matters of academic concern have been dealt with by the Department's faculty as a whole. Under the divisional scheme the teaching and also the general lines of research in the field of the Division, are determined by the faculty of the Division under the divisional chief. Although the Division thus enjoys autonomy within the Department, its staff form part of the Department's faculty and sit with that faculty in determining departmental affairs.

(*Concluded on page 118*)

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BIOLOGICAL SCIENCE

(*Concluded from page 116*)

The divisional idiom accomplishes three highly valuable objectives: (1) It lays the responsibility for the teaching and research in particular areas in the hands of those best qualified for such responsibility; (2) It permits and encourages close co-operation between those trained primarily in chemistry or physics with those more biologically orientated; (3) It places the planning of the Department's affairs in the hands of the divisional chiefs under the chairmanship of the Department Head. Thus is encouraged the highest professional standards in individual fields without sacrifice of the co-operation and synergism which lead to a unique idiom and to progress in analytical biology. It is expected that, when circumstances warrant, a Division of Biophysics will be established along lines similar to those which characterize the Division of Biochemistry. It would be premature to discuss still further future developments though it is obvious that, in the evolution of the Department, still other new departures may be expected.

To progress rapidly in the solution of problems of analytical biology, it is becoming more and more necessary to employ the full battery of physical and chemical techniques. Few, if any, individuals are capable of doing this alone. More and more, co-operation and teamwork are needed between experts in the various disciplines and subdisciplines. Such close interaction may be expected to become increasingly more efficient under the divisional scheme now adopted than if the various aspects of biology (biochemistry, biophysics, cell physiology, and so on) were given full departmental status. There is thus developing a "Biological Institute" within the Institute devoted to teaching as well as to research in the general field of analytical biology. This department or "sub-Institute" will, I daresay, have important interaction on the entire scientific body of the Institute. It has already had, and will enjoy an ever increasing impact on teaching and research in this aspect of biology nationally and internationally.

In closing this brief article about our new building, I should indeed be remiss in my duties to my colleagues if I did not express, on behalf of them and of myself, our deep appreciation both to the principal donor of the building, the Campbell Soup Company, and to the Administration of M.I.T., which allocated the funds needed. We also acknowledge with our best thanks the very substantial gifts of the Rockefeller Foundation (to be applied to the general needs of the Department) and of the Commonwealth Fund (to assist in the training of postdoctoral medical fellows) and to our numerous other benefactors.

At this writing the Department has occupied the Dorrance Building for about 10 months. While this building is no exception to the rule that no building is perfect, the staff and students have already learned to love it and to be very proud of it. We wish to express our appreciation, and we pledge our best efforts to use the new facilities in a manner best calculated to advance teaching and research in biological science.

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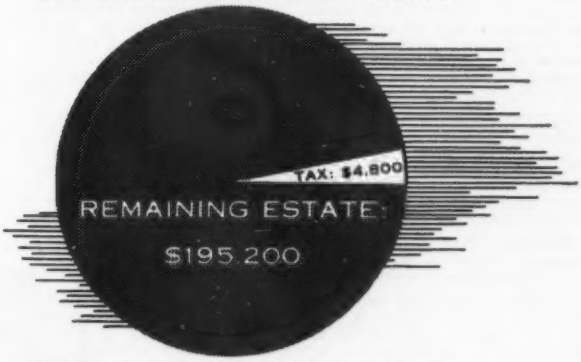

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THE TREND OF AFFAIRS

(Continued from page 80)

it is seventeen hundred dollars per capita. Fortunately, electronics technical personnel are above the national average as to economic status. This means, however, that they are carrying a greater than average share of the national debt. The debt of each family head is in reality not less than twelve thousand dollars. Via the tax route you must each year pay the interest on this amount as well as amortize some part of it.

"In thirty years we have seen the number of broadcast receivers in use increase from nothing to 115 million. It is today a reasonably steady industry, although quite competitive. Television set manufacturing, while also very competitive, is growing much faster than audio radio did at the corresponding age period. Television sets in use increased from practically nothing in 1947 to about twenty-six million at the present time. An annual increase of better than six million is currently indicated. In ten years may the number of TV sets in use be approaching 100 million?

"There are about 2,500 A-M broadcasting stations on the air, together with nearly 600 F-M stations. About 230 TV stations are already in operation with approximately another 450 holding construction permits. There are already definite indications of lack of competent technical operating personnel. In safety and special radio services, over two hundred thousand stations are in operation. In spite of current shortages in technical personnel, this is a field that has been attractive to radio men, which is just another way of saying that pay tends to be on the low side.

"Over-all electronics employment does not have much meaning because of lack of exact definitions. The Bureau of Labor Statistics indicates that there are approximately 170,000 persons employed in the radio and television industry with nearly another 200,000 in other branches of electronics. These presumably include those in the vast field of guided missiles and allied defense projects. Much of this data was obtained through the assistance of the Radio-Electronics-Television Manufacturers Association. What about the whole computer field? Is there not also large and ever increasing employment there? I wonder how many people realize the extent that manufacturing and mercantile companies will be employing electronic business machines in the years ahead. The already developed shortage of clerical personnel makes rapid development in this area a certainty.

"There is also indication in spite of the Korean truce that large sums of defense funds will continue to be allocated to electronic research and production. 1954 may well be a record year for delivery of electronic equipment to the military. However, do not let us become more heavily involved in government operations by letting government become more involved in communications activities, be they direct communications or broadcasting. If we allow this governmental encroachment, I predict that real opportunities in our industry will be substantially reduced.

(Concluded on page 122)

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THE TREND OF AFFAIRS

(*Concluded from page 120*)

"Five years ago in addressing the annual convention of the I.R.E. I took vigorous issue with the Department of Labor, which had just advised students to keep away from engineering because it was an overcrowded field. I stated that if there were lack of employment it would be only from lack of sufficient training, which would limit employment to levels below the aspiration of the young engineer. Futhermore, I then stated that more positions than ever before were indicated for those adequately prepared for them. This was further amplified by the statement that I felt in the twenty-year period starting with World War II the employment of degree-holding personnel in electronics would increase twentyfold. This I still believe to be true.

"In closing, one word of caution would seem to be in order. Things that come easily lose their mark of value. Today, in the vast field loosely called electronics, employment is plentiful. This field will continue to expand, so continue to be prepared to meet the advances of the art, which have been and will continue to be great. More and more will applied physicists replace technicians, and with the ever increasing complexity of equipment, capable mechanical engineers with an understanding of electronic principles could well become the high paid group of our industry. In whatever activity one engages in, it is always well to recall the old axiom which says that greatness comes not so much from the power to command as from the acceptance of the obligation to serve."

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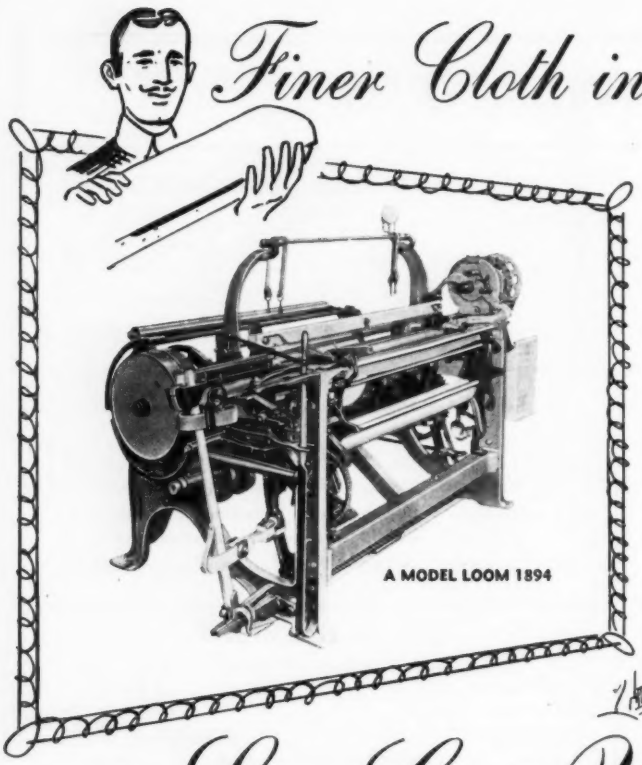

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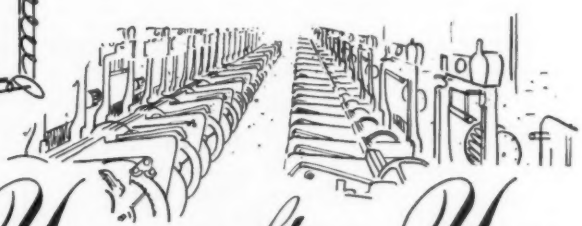

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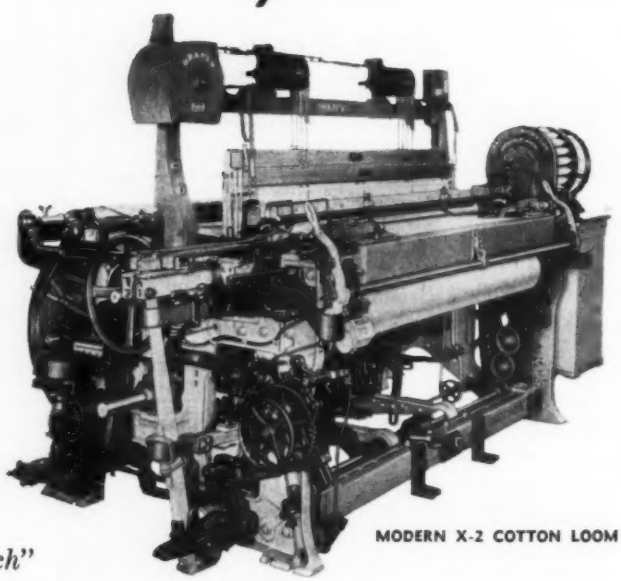

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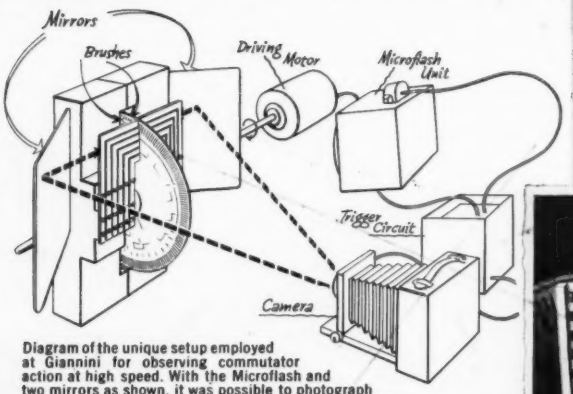
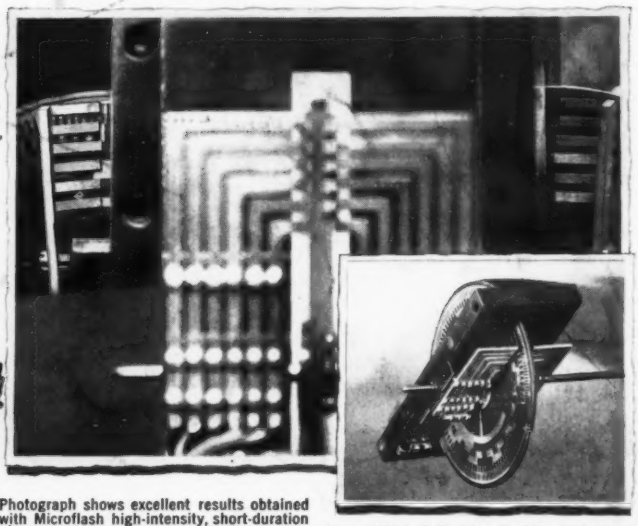


Diagram of the unique setup employed at Giannini for observing commutator action at high speed. With the Microflash and two mirrors as shown, it was possible to photograph both sides of the commutator at the same instant of time and with equal exposure.

When design engineers had to observe the brush contact points of a developmental analog to digital converter, while the commutator was actually rotating at high speed, they called for a G-R Type 1530-A Microflash. The high-intensity, short-duration flash provided by this equipment was instrumental in the development of the Giannini model 14310 Analog Position Encoder.



Photograph shows excellent results obtained with Microflash high-intensity, short-duration illumination. Back view of either side of commutator and front view are shown. Photos courtesy G. M. Giannini and Company, Inc.

Commutator of Angular Position Encoder is photo-engraved with twelve rows of conducting segments which contact twelve stationary brushes. This enables Encoder to measure angular rotation of 360 degrees with an accuracy of ±0.1%.

Type 1530-A Microflash $640

The Microflash has been successfully applied to the study of many phenomena in pure and applied science. It is widely used in studying the effects of abrasion, turbulence in liquids, and mechanical distortion at high rotational speeds.

Other applications include study of the disintegration of high-speed rotors, investigation of projectile flight and impact, and experimentation dealing with the propagation of fractures in various materials. In mechanical design, the Microflash is an indispensable tool for studying the action of springs, valves, cams, cranks, bearings and other parts moving at high speeds.

★ *G-R Type 1530-A Microflash provides an intense white light for single-flash photography of very rapidly moving objects — flash intensity is 20,000,000 beam candles — duration is only 2 millionths of a second*

★ *Power supply and trigger circuits are assembled in one metal case, lamp is in another — two sections lock together for complete protection of all controls and ease in transportation*

★ *Panel pushbutton initiates flash — alternative is to have flash tripped by noise or pressure wave associated with the action to be photographed; microphone and built-in amplifier are provided for such use*

★ *Additional jack is available for flashing from any simple external contactor — photoelectric cells, wire breaking under tension or impact, and many other easily-built devices will trip flash to suit the application*

★ *Conventional camera equipment is used*

★ *Accessories supplied include microphone with cable, tripod, spare pilot lamps and fuses, 2 spare flash lamps, and plug for connection to external-contactor trip jack*

★ *Dimensions are 24⅛ x 13¼ x 11¾ inches, overall — net weight is 72 pounds*

★ *Price:* **$640.00**

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